CHILDREN'S DIGITAL BOOKS

Development, Testing and Dissemination of Quality Criteria

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University in Stavanger
July 2023

ISBN 978-82-8439-172-4

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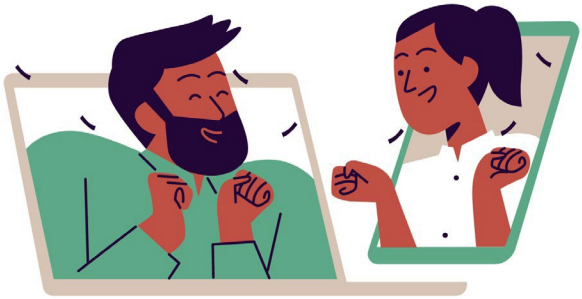


FOREWORD

Amidst the prevailing discussions on educational technologies, commonly known as EdTech, and fuelled by the surge in online teaching during the COVID-19 pandemic and recent breakthroughs like the public release of OpenAI's ChatGPT, there is a growing interest in what works and why. To provide a focused exploration, this report is dedicated to examining the quality features of a particular type of EdTech: children's digital books.

The landscape of children's digital reading experiences is evolving and researchers, policymakers, and publishers need to keep up. With the increasing prevalence of media in children's daily lives, including access to various digital devices like phones, computers, and tablets, it is no surprise that digital books have become widely used, both at home and in educational settings. However, as digital technology continues to shape the way children interact with books, it is important to examine the characteristics and learning opportunities that high-quality digital books should offer. This report aims to provide some insights into current research on content and design features of digital books, as well as an evaluation of popular reading platforms for children. By openly sharing our evaluation methodology and findings, we hope to encourage thoughtful discussions and reflections on how to best support children's reading experiences in the digital age.

Whether you are a publisher, EdTech designer, or researcher, we hope you will find this report useful for understanding the potential of digital books and their key quality indicators. The report is part of our efforts to encourage more dialogue between researchers, experts, and app developers to see digital libraries that fully benefit from technological possibilities while also providing safe, enjoyable, and educationally valuable experiences for young readers. Join us as we explore the fascinating world of digital reading and its implications for young readers.

Professor Natalia I. Kucirkova

EXECUTIVE SUMMARY

- Quality digital children's books are expected to offer a reading experience that goes beyond the traditional paper book by including interactive and multimodal features, open-ended spaces for dialogue, children's creativity, and agency. The technology is available; however, it is not yet harnessed to reach its full potential.
- Digital reading platforms need to be designed as supportive, inclusive, accessible, and safe environments to support children's learning and reading for pleasure.
- **Nine quality criteria** have been selected, based on an extensive literature review, and tested on ten digital reading platforms (Appendix 2) from a children's user experience standpoint. The quality criteria focus on the design and content of the platforms/books and whether they are:

  Purposeful, with a clearly stated purpose and aims, including detailed information about the developers and content creators;

  Sustained, providing opportunities for motivating and engaging repeated interactions with the books;

  Intercultural, with a content and design that sensitively and appropriately represents and reflects its diverse young users while encouraging a dialogue across differences;

  Interactive, with multimedia features, including hotspots, that are designed to support, rather than distract from, the reading and learning experience;

  Child-friendly, with a format and navigation that is adapted to the needs and abilities of young children;

  Accessible, with the platform and book reading experience including various accessibility features;

  Personalisable, using children's personal and performance data ethically to individualise their learning experience and enhance their reading enjoyment;

  Creative, including open-ended, playful design features for an intellectually and creatively immersive experience;

  Social, including features and prompts that encourage social or parasocial interactions around reading.

- Most of the evaluated digital libraries have **a clear purpose** with reasonably well aligned content and design features. Nevertheless, all of the apps have space for further development

of design features such as interactivity, open-ended games, or congruent hotspots. Most of the evaluated libraries provide some information on their content creators; however, more information is desirable.

- Most of the digital platforms support **sustained** interaction with their content to some degree, but there is considerable space for further development.
- Most of the libraries we reviewed offer a positive, **intercultural**, learning environment, and some of the libraries focus on, for example, providing books in less spoken languages. In terms of representation and content, many of the platforms offer stories written by authors from the global majority as well as various folk stories; however, most apps would benefit from more advanced design features that would introduce young readers to responsive and culturally sensitive interactions, and foster their multicultural competencies.
- All of the evaluated digital reading platforms are to some extent **interactive**, though none of the evaluated platforms were rich in congruent multimedia. Equally, none of them were found to contain excessive amounts of distracting features.
- Some of the evaluated digital books are clearly more successful than others in terms of the **child-friendly** nature of their design; we suggest that all of the platform developers should consider how participatory design, that includes children in more active ways as co-designers, could contribute to the development of childrens' e-libraries in the future.
- None of the reviewed platforms had an extensive selection of **accessibility** tools and design features, some did not even have basic accessibility features. While the platforms generally acknowledge needs of diverse readers, this is not clearly reflected in their design.
- Some level of customisation seems to be a standard feature; however, features that allow for **personalisation** are missing. We urge developers to consider the diverse needs of their reader communities and to shift away from the unsustainable "one fits all" approach. Additionally, children should be motivated to step out of their comfort zones, which does not seem to be supported by the recommendation algorithms currently in use.
- Most of the platforms do not have any elements of an open-ended design or advanced features that would expand the possibilities around book reading. Thus **creative** and **social** interactions in e-libraries are currently very limited. Research shows the extensive benefits of dialogic interaction; however, it seems that most digital libraries are designed primarily to support children in independent reading. This is, perhaps, the greatest identified shortcoming of the evaluated platforms.
- Children's safety in online spaces is of utmost importance. While most of the platforms include information on **safeguarding policies**, they are not always sufficiently detailed or written in

clear and understandable language. None of the platforms addressed their child readers directly in this respect. None of the platforms had any disturbing content or advertisements.

WHAT ARE CHILDREN'S DIGITAL BOOKS?

Children's e-books, also known as digital interactive books, storybook apps, story apps, iBooks, interactive e-books, book apps, or literacy apps, are digital versions of traditional children's books that are designed to be read and interacted with on electronic devices such as tablets or smartphones. These digital books often include interactive elements, such as animations, sound effects, and touch-based interactions, that enhance the reading experience and engage children in the storytelling process. They provide an immersive and interactive way for children to explore stories, characters, and educational content, combining text, illustrations, and multimedia elements to create a dynamic and engaging reading experience.

Contemporary children's digital books represent a relatively new, yet fast growing format of children's books. Digital books can simply be texts and pictures in a digitised form, but they also often include various interactive features that have been designed to provide an appealing reading experience. Unlike print books, digital books can be dynamically shared, modified, and personalised in the process of reading both in terms of their content (e.g., stories made with story-maker apps such as BookCreator or MyStory) and format (e.g., customised text display). Digital books, especially those offered on mobile phones and tablets, and as part of online libraries, are often more cost-effective to produce and deliver to readers, who otherwise may not have access to reading materials in print and/or in their native language. The benefits of free access, immediate distribution options, and lower production costs of digital books have been, for example, highlighted during the recent COVID-19 pandemic. Development of digital books also continues to attract considerable children's development funds (such as the digital libraries financed by the All Children Reading: A Grand Challenge for Development, a partnership of United States Agency for International Development (USAID), World Vision and the Australian Government).

Besides the practical advantages of digital books, digital reading has the potential to play an important motivational role in the development of children's reading skills, alongside, or even instead of, traditional paper books. Research shows that many children, especially those labelled as "reluctant readers", may prefer to read digitally (Picton & Clark, 2015), as digital books may better support children's intrinsic motivation to read (Lasley et al., 2017). Studies have also shown that children report preferring to read digitally, or at least they like digital books as much as print books. While children often enjoy being able to actively choose to read digital books, their caregivers seem to favour, and actively mediate, the reading of paper books (Strouse & Ganea, 2017). Although the engaging and motivational aspect of digital books for children is well-established and supported by extensive research, their learning benefits are less clear. More research is needed in this area.

Three recent meta-analyses show that the learning benefits of digital books are related to the types of digital books under investigation (Swanson et al., 2020; Furenes et al., 2021; Schwabe et al., 2022). The quality of design of children's digital books attracted much research attention between 1995 and 2000, as summarised in a systematic review of 52 studies by Zhang and colleagues (2020). Their study highlights four key design features – multimedia, feedback-giving, gamification, and personalisation – as dominating the studies in this period.

We are aware that selecting and evaluating high-quality digital reading platforms is challenging and it needs to be noted that the current children's digital book market is unregulated (Taylor et al., 2022). Users are, therefore, often guided by various app rating systems and children's digital media. While investigating these ratings, Taylor and colleagues (2022) concluded that the indicative value of web-based app scorings is limited, due to insufficient potential for feedback or information on the app providers' policies. Our evaluation is therefore carried out from a user experience perspective. It is based on an extensive literature review, and focuses on the criteria identified from that review as quality features of children's digital books.

OUR QUESTIONS & APPROACH

The proliferation and the growing importance of digital books in children's lives opens new possibilities for children's literacy development but also raises new considerations around what makes a good digital book. It is very important for all stakeholders, including children themselves, to widely discuss and reflect on what makes a good digital reading experience and what the purpose of reading on screen or on paper is. Digital books have the potential to become not only more accessible, equitable, and more sustainable resource than paper books, but they may also provide new learning experiences and benefits if designed in line with the goals that benefit all the diverse groups of young readers. Unfortunately, according to current research and our own personal experience of digital books on the market, the design and content of digital books still has a long way to go to meet current learning standards and to provide children with a high-quality reading experience. As social justice and literacy researchers, we understand high-quality literacy experience as a fundamental right for children. We acknowledge the potential of digital books to foster social change as central to new developments in education, and with this report, we set out to contribute to the discussion on the advances in the field of digital reading by inquiring:

> What are the quality features of children's digital books in some of the most popular reading platforms and free online libraries today?

Our primary audience is the diverse stakeholders of the networked community around children's digital books - from designers, developers, and researchers, to families, schools, and authors - who together enable high-quality reading opportunities and experiences for children. Our report is not an in-depth study but an exploratory project that attempts to provide an initial summary of a vast research literature landscape, and start a discussion around what high quality digital reading should be like for young readers today. With the report we hope to provide a useful resource that opens up a dialogue among publishers, developers, designers, researchers, and other experts in this field. We also aim to open up communication channels between digital libraries and their users so that young readers can contribute to the development of digital books that better reflect their needs. We also hope that this report becomes a useful tool for teachers, practitioners, and parents, potentially helping them to navigate the current digital book market and assist them in evaluating the best digital resources for their child/ren.

Our approach to this report is threefold and sequential:

1. Scoping review of the research literature
2. Synthesis of key quality criteria
3. Rapid qualitative evaluation of ten digital libraries

In the first phase of the project, we conducted a literature review of peer-reviewed articles on children's digital books published in English between 2000-2023. We adopted a scoping review approach (Mays et al., 2001; Arksey & O'Malley, 2005) to map the quality criteria of digital books for children aged 3 to 8 years, as proposed in the research literature. The aim was to synthesise the relevant literature and derive a coding protocol for key quality markers of children's digital books, including: personalisation, adult-child interaction, gamification, interactivity, content, accessibility,

and representation. This type of review does not require the adoption of the full systematic review criteria, such as the weighing of the extent and quality of the research literature, as it focuses on summarising and making current research accessible to the various stakeholders in this field, such as, designers, practitioners, and families.

Our search was carried out using specified keywords to select and filter search results within the Scopus database, the world's largest database of peer reviewed abstracts covering a broad and comprehensive spectrum of research. The keywords used for this search were: *children and e-book, e-storybook, digital book,* or *e-reading* and *design, format, personalisation, adult-child, content, representation, accessibility, creativity,* or *safeguarding.* To screen the vast citation records, each research team member was assigned their own key words. They then read each abstract and used a decision tree to identify relevant studies based on two inclusion criteria: (a) the research reports on e-books or e-reading, and (b) it focuses on reading and reading experiences of 3 to 8 year-old children.

The scoping review helped us to identify a variety of topics central to the discourse on high-quality learning interactions with digital books. Where relevant, the scoping review was supplemented by reviewing additional sources. We identified and summarised literature on diverse users' experiences of digital books, including disabled young users, EAL, SEN, struggling readers, and communities of readers. The body of literature concerned with format, such as navigation, organisation, and ease of access features, was mainly centred around issues of choice, agency, and control. From the vast research field of children's digital book design, we derived the following key areas of focus in the field: interactivity, gamification, creativity, hotspots, multimedia (including augmented (AR) and virtual reality (VR)), and multimodality. We also synthesised literature focused on content and personalisation, where educational features, authoring, genre, and language of digital books, as well as intercultural considerations, were identified as some of the most central topics.

While the literature review and extraction of data was conducted by each of the team members independently focusing the search around their assigned keywords, the synthesis of data and the identification of frequently discussed key quality features of children's digital books was completed collaboratively to mitigate research biases. Extracted data was shared together with a relevant context in a joint file and synthesised collaboratively through an iterative process of revising, renaming and rearranging the findings until consensus was reached. Any discrepancies were resolved through group discussion and re-reading of the relevant literature.

To summarise the literature and develop a set of key quality criteria for children's digital books, we reduced the findings into several themes, which we organised into categories and developed a conceptual map. We then looked for relationships to further synthesise the identified themes into encompassing categories. These were checked against existing broader quality assessment schemes, frameworks, and rubrics for children's educational apps, including those developed by Meyer and colleagues (2021) and Huntington and colleagues (2023), as well as the six key facets of digital books identified to promote children's reading for pleasure (Kucirkova et al., 2017). The result of this process led us to nine key quality criteria, visually summarised in the Word Cloud below. These nine quality criteria were derived from scholarly articles and studies concerned with effective reading interactions that support children's engagement in reading and reading for pleasure.

The nine key quality criteria for children's digital books:

1. **purposeful**
2. **sustained**
3. **intercultural**
4. **interactive**
5. **child-friendly**
6. **accessible**
7. **personalisable**
8. **creative**
9. **social**

Once we had identified the quality criteria, we then evaluated ten selected popular children's digital libraries against these criteria (see Table 1 for a list of the libraries). The research questions we asked in evaluating these libraries were:

1. To what extent does the digital library contain purposeful, sustained, and intercultural learning opportunities?
2. To what extent does the digital library offer an interactive, child friendly, and accessible experience?
3. To what extent does the digital library promote personalised, creative, and social engagement?

We adopted a rapid evaluation method (McNall & Foster-Fishman, 2007) and developed a simplified qualitative codebook to apply the derived criteria to the evaluation of the ten children's digital libraries (see Appendix 1). Applying the coding framework systematically, two researchers each evaluated five of the library platforms simultaneously while continuously discussing any inconsistencies to reflect on the coding framework (O'Connor & Joffe, 2020). Each of the quality criteria was rated on a scale of high, medium, and low presence, indicating that a quality criterion was either present, partially present, or not present at all. High presence of a quality criterion indicated higher likelihood of the digital library to positively impact children's learning and reading experience and low presence suggesting that improvement in this area is needed.

The ten digital libraries were selected based on their popularity (customer reviews) and market potential (current market share and reach), as established by the International Collective of Children's Digital Books. Of the libraries selected for evaluation, some are commercial, and others are offered for free (see Table 1). The exploration of the key features of the platforms was constructed from the user experience standpoint without access to the libraries' underlying algorithms. We assessed each of the ten platforms selecting a sample of five books from each of the libraries and engaging with the platforms various features and interface against each of the nine criteria systematically, gathering contextual information directly from the platforms, their books, and/or their accompanying websites to determine to what extent they align with current research (e.g. Chen, 2015) and to what extent they support high-quality reading experience for children.

COMMERCIAL E-LIBRARIES	FREE E-LIBRARIES
Epic	African Storybook
MagicBlox	Bloom Library
Pickata le	BookBot
Polylino	Global Storybooks
	Storyweaver
	WorldStories

Table 1. The digital libraries evaluated in this report.

WHAT MAKES A GOOD DIGITAL BOOK?

Children's books are special, in that they combine pictures with texts to convey meaning for aesthetic, didactic, and social purposes (Goodwin 2008, Kucirkova 2018). This means that children's books are not meant to be only entertaining or educational, they also play an important role in children's social lives and in how they interact with the world around them (Simpson and Cremin, 2022). They are designed to captivate children's attention with engaging stories and colourful illustrations, all while encouraging the development of literacy skills and complex meaning-making processes that help children to understand self, others, and various events in their life. A child reader is similar to an adult reader in that young readers have diverse reading interests, skills, and needs, and different also, in that young readers gradually develop their cognitive and affective skills, life experiences, and experience of reading as they learn to read (Nikolajeva, 2014; Reynolds, 2011). The design of digital books for children, therefore, needs to reflect these premises.

The aesthetic purpose of children's books aligns, in many ways, with the idea of 'reading for pleasure,' focusing on children's intrinsic motivation to read and developing positive attitudes towards reading. The didactic purpose aligns with educational aims such as vocabulary development, reading comprehension, and reading fluency. Ultimately, however, children's books broadly support children's development – through real and fictional worlds, and descriptions of abstract and fantasy worlds, books mediate world views and give children the opportunity to identify (or not) with book characters, therefore influencing, for example, the recognition of emotions or the development of skills such as empathy.

In alignment with these broader purposes of children's books, we identified nine interlinking categories as crucial quality indicators of children's digital books, derived from a scoping review of current research on children's digital books. We divided our nine criteria into three sub-groups with three indicators for each. The first set of criteria relates to learning opportunities that books offer. We assess the content and design in terms of the school curriculum, literacy aims, and diversity of reading opportunities. Here we look at whether the books/platforms are designed in a *purposeful* way, whether the design of the books encourages *sustained* interaction, and whether the content supports *intercultural* competence and positive learning about self and others in the world. The second group of criteria focuses on user experience. Here we assess the *interactive* features of the books: whether the books are designed in a *child-friendly* way and whether they are *accessible* for diverse end-users. The third and last group of criteria considers the potential scope of the child's engagement with the book (this category is a reduced version of the Reading for Pleasure criteria used in the UKLA Children's Digital Book Award). Here we look at whether the books have *personalisable* features, how many *creative* elements they incorporate, and the extent to which they allow *social*, or parasocial, interaction, such as, for example, how much they support co-reading between the child and an adult or several children together.

These key criteria are, as can be expected, represented in different digital texts to a different extent. However, in alignment with previously identified criteria for children's digital books, they are an attempt to "emphasise the importance of perceiving digital and printed texts on a continuum, which affords reading experiences that are physical and intellectual, and emotional and cognitive" (Kucirkova & Cremin, 2018, p. 572). The following sections detail the nine quality criteria we identified in the literature for evaluating children's digital books. We describe each criterion with references to relevant literature to substantiate the need for the indicator and contextualise our choice of the indicator in relation to published studies concerned with this aspect of children's digital reading.

Purposeful

Meaningful learning occurs when learning has a purpose (Hirsh-Pasek et al., 2015). Whether designed for schools or for families, or for supporting children's phonics or vocabulary acquisition, the content and design of digital reading libraries must be firmly centred around the platform's aims. These aims should also be clearly communicated by the designers so that teachers, together with parents/caregivers and children, can make an informed decision about which library is the most suitable for their needs. In order to support the emergent literacy of children at risk of learning disabilities, Shamir and colleagues (2011), for example, created a specially developed digital book version of the popular Hebrew children's book, *Confused Yuval* by Miriam Roth. Their design included a 'Read and Interact' mode – a unique set of multimodal features, specifically designed to expose children to phonetic segmentation among its other objectives. Purposeful digital books with educational value must be "cognitively challenging, attractive, motivate students to learn and encourage active participation" (Shiratuddin & Landoni, 2002, p. 175). Nevertheless, many platforms and apps marketed as educational do not have clear learning goals and do not stipulate their learning purpose Hirsh-Pasek, et al., 2015). Mayer and colleagues (2021) revealed that the majority of 100 most downloaded 'educational' Android and iOS apps for young children had a low educational value including the lack of a clear learning purpose. They also found that apps labelled 'educational' contained advertisements that distracted from the app's underlying learning purpose (Mayer et al., 2019). App designers and app stores should therefore work with child development experts (Meyer et al., 2021; Dore et al., 2018) and/or digital literacy experts (Egert et al., 2022) to develop purposeful digital book platforms that support and scaffold children's literacy development. This implies design that refrains from following commercial goals that maximise entertainment through distracting and attention-grabbing features and design options (Radesky et al., 2022).

Sustained

Sustained engagement is regarded as beneficial for language and literacy development (Korat & Blau, 2010) and refers to children's repeated interactions with digital books such as re-reading text and re-visiting characters and stories. Repetition is an important reading practice that, for example, encourages incidental word learning when children learn words on their own from the context of a story (Neuman et al., 2021). Repeated exposure to the same words, with or without an adult present,

better enables children to commit these words to memory. Horst and colleagues (2011) found that children are able to recall and retain novel words when the same stories are read to them repeatedly. Repeated reading is also important because it has been found that during co-reading, parents speak more on first reading and only make space for children to speak more on future readings (Strouse et al., 2013).

Rather than a repeated reading in a single medium (e.g., a digital book), listening to and reading stories in two different media or formats (e.g., audio or video and paper book) is more effective in promoting new word acquisition (Neuman et al. 2021). For example, "a link to a YouTube video could be embedded within the app to provide a child with additional extended instruction, practice, or review of specific words and/or concepts" (Dennis, 2016, p.26). Repetition represents one of the most common reading strategies parents employ as they help their children recall and retell stories (Liu et al., 2013), and Abdehaldi (2020) notes that repetition is also the most common (in 40% of the studied cases) immediate response to interactive apps with learning content. During repeated interactions with audio hotspots (interactive features designed to emit sounds), parents repeated what they heard which was then also repeated by their children and this led to deeper engagement with both reading and learning (Abdehaldi, 2020). When rereading digital texts with synchronous narration and word highlighting, children's word recognition was also found to substantially improve (Korat & Blau, 2010).

While repeated reading is beneficial to children's progression in language development, it may also be boring if enforced (Korat & Blau, 2010; Penno et al., 2002). That is why it is crucial to design digital books such that repetition and rehearsal of information can occur more naturally. Kucirkova (2016), suggests that digital book personalisation features may encourage sustained engagement and motivate children to re-read books. This is echoed by Mangen and van der Weel (2016), who also argue that relevant and personally meaningful reading activities motivate children to engage in sustained reading through rereading books or parts of the child's favourite books. Well-designed hotspots, for example, can encourage children to return to and engage more deeply with the text if the activated content relates to the main themes in the digital books and supports understanding of the storyline (Abdehaldi, 2020). Similarly, a book reader software "may be designed to help parents appropriate a variety of strategies based on the needs of different children" for more sustained reading (Liu et al., 2013, p. 147).

Intercultural

Globalisation trends are clearly visible in the children's book market, signaled by an increased interest in "transnational" reading, which includes translated texts and combines elements from different cultures (Bradford, 2011). Reflections and representation of diversity have long been a concern in children's books, but many reports and surveys indicate that there is a discrepancy between the diversity found in children's literature and the diversity observed in society. A longitudinal survey of ethnic representation in children's printed books on the UK market shows that the proportion of books with a main character from a racial minority background remains very low (CLPE, 2022). The digital medium affords greater access in many respects; however, intercultural considerations remain under-researched in children's digital media more broadly (see Kneeskern & Reeder, 2020) and in digital books more specifically. Though the wider field of child-computer interactions considers diversity,

equity, and inclusion issues, this is primarily from the perspective of children with disabilities (see section 'Accessible'). Less emphasis is placed on questions of racial bias, systemic injustices, or overall representation (Borge, 2023).

While book personalisation enabled by digital technologies explicitly allows children to focus on 'self' (see section 'Personalisable), which may then contribute to increased reading motivation and enjoyment (Kucirkova et al., 2021), it is extremely important for children to be able to locate their 'self' in relation to others. Diverse experiences, images, and textual descriptions in books are vital sources of diversity for children to explore and encounter. The variability found in students' learning, including diverse abilities, cultural backgrounds, experiences, and languages, is often addressed through universal design learning frameworks in education (Levey, 2023). These frameworks have been used to guide inclusive curriculum development, where the underlying principles stress multiple means of representation (a variety of formats and also material), engagement (including real-world relevance), action, and expression (Oakley, 2019). Digital technologies that include personalisation allow children to follow their interests and have agency also in this respect (Kucirkova, 2018; Oakley, 2019). Yang and colleagues (2022) highlight the potential of digital books that are powered by bilingual discussion prompts as an effective and inclusive tool for families from diverse linguistic backgrounds.

Children gradually develop the concept of 'cultural self-awareness', for example, recognizing the ways in which one's own world is reflective in others (Bennett, 2009). Ideally, over time, cultural self-awareness develops into 'intercultural sensitivity' (Bennett, 1993) and further into 'intercultural competence' (Hammer et al., 2003). Intercultural sensitivity and competence are relevant for the design of reading material, which needs to provide sufficient multicultural conduits and promote cross-cultural awareness among users. Sylla and colleagues (2022), for example, advocate for intercultural storytelling as it has the potential to empower "children of different cultures to tell their stories to their peers" (p. 13). As such, intercultural storytelling also supports some of the key aspects of historical, political, and human-rights education. In order to convey a fair representation of cultures in their app development, Sylla and colleagues (2022) adapt and develop criteria proposed by Leite and Rodrigues (2001). These criteria include considerations of a) ethnic, physical, and gender diversity; b) high-fidelity visual representation on the digital screen that is based on collaboration with local informants and extensive research; c) situated diversity that avoids decontextualized stereotyping; d) representing diversity within each cultural group; e) emphasis on friendly and cooperative relationships between the human characters in the app; f) space for personal discovery; and g) structures that facilitate reflections on human diversity.

Borge (2023) considers aspects of a positive and empowering environment specifically for children from global majority in order to develop multicultural competence, including knowledge, skills, attitudes, and beliefs. He proposes six principles to guide technology design. These echo the considerations voiced above; he recommends the design of digital books and other educational platforms for children provide positive learning about self and others in the world, the choice of minoritized characters to be knowledgeable and non-stereotypical, and, preferably, a consultative design process with experts from minoritized groups to avoid biases, to stress positive relationship building and promote empathy, while including elements of positive reinforcement and space for constructive and sensitive feedback.

Interactive

Digital books are designed on a continuum from non-interactive to highly interactive. Non-interactive books are designed to simulate a traditional "paper" book reading experience with page turning being the only interaction. Some books may, in addition, include sound, for example, the sound of page turning, or background music. Many digital books include a "read to me" option, also referred to as 'talking e-books' (e.g., Pereira et al., 2019), which activates an audio narration. The multimodal features included in book design, such as, text, audio, illustrations, and animations, may be automated so that the reader has limited control of their use, or they may invite the reader to participate in the meaning-making process by further exploring the included multimodal features (Abdelhadi, 2020).

Interactivity in children's digital books is a widely researched and debated aspect, which is not surprising considering that interactivity embedded in digital books directly distinguishes digital and traditional paper books. The current literature shows that some interactive features have a positive effect on the children's user experience or comprehension (see, e.g., Colombo & Landoni, 2014; Pearman, 2008; Korat, 2010), while other interactive features are actually distracting, and may consequently, hinder comprehension (Bus et al., 2015). Researchers provide clear guidance on this, for example, that interactive features should be used strategically to support children's attention (Korat & Shamir, 2007), and that interactive features should support the text while providing clear signals when the interaction is triggered (Dünser & Hornecker, 2007). Schugar and colleagues (2013) propose designing interactive digital books with considerations of the ratio of supporting and extending interactions to distracting interactions, the time required to engage in interactions, and the frequency of their placement.

The nature and volume of interactions links to concerns about young readers' ability to process presented information. Young children's processing capacity develops gradually, and simultaneous multimodal inputs may cause information overload. At the same time, according to the dual coding theory that human cognition is divided into visual and verbal processing systems, it may be that the combination of related text and images actually enhances comprehension (Clark & Paivio, 1991). Drawing on both processing channels simultaneously, nonverbal information may support the language comprehension, including learning new words and grammatical features, while verbal information may help to comprehend, for example, unfamiliar images (Bus et al., 2015). The design of the interactive features should, therefore, actively involve the user in the story/content. The activities arising from interaction should be content relevant and not distracting. This is especially true for young children with less matured executive attention network, as the mismatch between the story content and an embedded interactive element may interrupt the information processing, increase the cognitive load and consequently the quality of encoding, and limit text understanding. Researchers thus recommend that the amount of interactivity is aligned with cognitive maturity of children and is age adequate (Bali et al., 2023). In conclusion, if designed appropriately, multimodality, in connection with interactivity, may positively increase children's engagement with the digital book, whether reading on their own or while co-reading with their carers (Zhang-Kennedy et al., 2017; Smith, 2012).

One of the much-debated specific design features are 'hotspots' – clickable locations on the screen that activate a design element, such as animation and/or sound. The design of hotspots can be

congruent with the story/content of the book and support comprehension and engagement, while other hotspots may be incongruent and have a purely entertaining/aesthetic function which may be distracting rather than beneficial (de Jong & Bus, 2003). Research shows that supplemental multimedia, such as hotspots, but also including background effects, animations, text highlighting, narration, background music, and sound and/or camera effects, that align with the storyline/content are largely beneficial because they seem to increase children's active involvement in the reading process (Korat & Shamir, 2008). These features, by directing the child's attention to specific places in the text, may provide additional information and context, contribute to general knowledge acquisition, and promote understanding of abstract vocabulary (Takacs et al., 2015). Animated illustrations seem to be especially effective in guiding the child reader's attention towards the relevant information on screen and thus facilitate more successful integration of the verbal and non-verbal information (Takacs & Bus, 2016). Sound effects and music may contribute to the recognition and understanding of emotions and mental states (Altun, 2018; Kucirkova, 2019a) or simply set the mood as a way to support understanding (Pearman & Chang, 2010). Studies in the field of embodied learning also highlight the importance of integrating physical movement, such as the nature of the haptic interaction itself, into the learning process (Jusslin et al., 2022).

However, as discussed above, research also clearly shows that benefits of reading digital books are primarily linked to children with good attention control abilities, while children with less developed attention control, may perform worse in interactive reading environments (Bali et al., 2023). Bus and colleagues (2015, p. 92) suggest that app developers focus on dual-coding "by facilitating the matching of nonverbal information sources with the oral text". Adherence to spatial and temporal congruency and proximity between narration and non-verbal information in electronic storybooks then offers "new opportunities to promote story and text comprehension" (ibid.).

Interactive features can, but do not need to be, multimodal. Some interactive features might be offered through visual engagement only, while others through images and sounds, and some might also engage children's haptic sense (touch). Given the divergent conceptualisations of the term 'interactivity' across research studies, the literature is not clear on which types of interactive features work best (Kucirkova, 2019b). Takacs and colleagues (2015) suggest that interactive features defined as additional activities such as puzzles, various tasks, funny visual, and/or sound effects that are to be activated by the user do not support children's story comprehension and vocabulary learning regardless of their congruency, while multimedia, such as pictures, sounds, and audio-narration, do support comprehension and vocabulary development. Zipke (2016) found that children's word recognition and story comprehension scores were higher with children that used interactive digital books rather than print books, but the study did not distinguish what type of interactivity was included.

In another study, which looked at preschoolers' use of various modes, it was found that the 'auto-read' mode may lead to lower inference and critical reading scores but also less strategic use of hotspots (Christ, et al., 2019). 'Auto-read' may thus not be the best feature for emergent readers in terms of their literacy development. Developers of books for emergent readers should, therefore, design hotspots that support sequential transactions with the text (ibid.). Pereira and colleagues (2019) point to studies that support the view that 'talking e-books' represent a useful digital scaffoldfor emergent readers while stressing that especially disadvantaged children may benefit from digital books affordances.

Another feature of digital books that is often studied in literature and included under the umbrella term of interactivity is 'gamification'. Gamification refers to the use of game elements in the app design (e.g., badges, leader boards, and avatars) in a non-game context to create a playing-like experience (Bell, 2018; Kapp, 2012) (see also section 'Personalisable'). Gamification is increasingly being tested and used in pedagogy based on the premise that learners have fun within gamified learning environments, which, in turn, leads to increased learning motivation (Buckley & Doyle, 2016). Digital books might blur the line between books and games (Martens, 2014), as they may, for example, include features of augmented reality, in which readers get a 3-D visual experience of the story, expanding reading into a whole-body engagement.

In a mixed method study examining the effects of gamification pedagogy within a gamified reading platform on students' reading interest, motivation, habits, and abilities, Xiuhan and Wah Chu (2020) found that outcomes improved if the students were actively involved in the gamified reading platform (see also, Prados Sánchez et al., 2023). However, "[g]iven that the comprehension of an interactive story app requires specific reading skills and strategies, it is necessary to develop pedagogical materials and tools that support the development of student's reading competences related to multimodal texts" (Salaberri, et al., 2021, p. 140).

Reading with and to young children is not only important for literacy development but is also an important home-based activity that is beneficial for children's emotional and social development (see also section 'Social'). Some research, however, suggests that highly interactive digital books may be at odds with co-reading as both parents/carers and children can become frustrated by mutual interference with the interactive features (Chiong et al., 2012). On the other hand, research also shows that open-ended digital storybooks that encourage a child's direct involvement in the story, for example by becoming the hero, "reposition both the child and parents as active agents in the story sharing, [and] can encourage the child to produce unique and empowering responses to the text" (Kucirkova, 2019b, p. 288; see also, Aliagas & Margallo, 2016). Pereira and colleagues (2019, p. 276) conclude that "children's digital meaning-making goes well beyond the orchestration of multimodal meanings in a given digital text". Young children are able to connect the meaning layers between the interconnected texts and modes and integrate them "into new, coherent, multimodal layered complexes (in their minds) and then to use such final complexes as trigger-texts for conscious learning" (ibid.; see also, e.g., Walsh & Simpson, 2014).

Child-friendly

Software design for children may be challenging, as children have their own needs that are quite different to those of adults (Druin, 2003; Norshuada & Landoni, 2002). Too often, design neglects these needs, and children have to use software that requires far too complex levels of interaction and assumes skills that children are still developing, such as good spelling and reading ability. Most user-interfaces take for granted that their users are proficient readers with extensive, often specialised, vocabularies, while young children may not even know the full alphabet and older children may not fully comprehend complex text-based instruction with unfamiliar vocabulary (Chiasson & Gutwin, 2005). In addition, children are often creative spellers, and typical interfaces are not necessarily able to recognise their text input (Hutchinson et al., 2005). Younger children may have difficulty with abstract concepts, and navigating complex interfaces can be beyond their abilities. Rubegni and colleagues (2021) found that children under the age of three could not interact with the tasks in the digital book the same way as older children.

Interfaces designed for children should prioritise strong visual elements (Druin, 2003). Instead of requiring direct text input, they should provide children with menus or lists to choose from (Hutchinson et al., 2005). It is not recommended to use complex menus or submenus, as children may struggle to categorise and navigate them effectively (Druin, 2003). Children typically learn to use software through trial and error, so they expect immediate feedback from their interactions with the application. To enhance usability, icons should visually represent familiar real-world objects whenever possible, rather than abstract concepts (Hanna et al., 1997). Additionally, incorporating design elements like rollover audio, animation, and highlighting can help direct children's attention towards specific functionalities (Bali et al., 2023).

Children's motor skills develop over time and young children may experience difficulties in controlling the mouse for movements such as dragging (Strommen, 1994) and targeting small areas on the screen (Hanna et al., 1997). Therefore, the icons need to be big enough and spaced so that the chance of accidentally pressing the wrong button is minimised. Cunningham and Zhang (2008, p. 186), extrapolating from software design for playing songs, confirm that "[a]n attractive interface must still adhere to basic usability principles," and found, in particular, that "children had difficulty with small fonts, small buttons and 'handles', right clicks, drag-and-drop, and double-clicking." Thus, while a software designed with multimodal and interactive affordances is desirable, the designers need to be aware that interaction with these affordances is reliant on the abilities (and choices) of the user as well as their general experience and knowledge about when and how to tap, press, scroll, pinch, etc. to activate the content (Christ et al., 2019).

Cunningham and Zhang (2008) stress that while software designed for adults provides information and functionality, this is better avoided when designing for children. They make a list of essential design criteria for children's software, that are relevant for digital books too: "clear navigation paths; [...] features grouped by functionality, and clear guidance through multi-step processes; use of point-and-click rather than double-clicking, right-clicking, or drag-and-drop; and a colourful design with large clickable areas" (p. 187). In their software development, the key element of the design

development was a strong participatory design focus, with development and testing with children (see also Sylla et al., 2022). By actively involving children throughout the development stages, the software can be tailored to better meet their needs and preferences. This approach ensures that the software is user-centred and aligned with the unique requirements of children, ultimately enhancing their overall user experience.

It is desirable that children have control over the information flow, especially for timing and content, to increase their agency, active participation in reading, and so as to adjust to their individual needs. The design of digital books should, therefore, include clear backward/forward/stop/replay icons (Atta & El Wahab, 2015). The quantity of the text needs to correspond to the assumed age of the reader. The font size and colour must be considered as well (de Jong & Bus, 2003). Several of these recommendations have been directly tested in research. For example, Haverkamp and colleagues (2022) studied the potential effects of screen size (smartphone vs. tablet) and text movement (scrolling vs. paging) on understanding, strategic backtracking, and reading motivation with interesting results: while scrolling on a tablet led to a more positive experience than paging or scrolling on a smartphone, paging generally tended to lead to better understanding and more backtracking. Scrolling is generally considered more challenging in relation to comprehension because it distorts the spatial layout (Piolat et al., 1997), while paging is presumed to be easier because it locks in the spatial location of text (Baron, 2021).

Music and sounds in digital books can easily lead to interference and worse comprehension performance especially in children with language impairments (Bus et al. 2015). Clark and Mayer (2008) have, in this respect, formulated several useful principles for child-friendly design: (i) the coherence principle, which states that surplus or extra sounds that have no relationship to content should be avoided; (ii) the spatial contiguity principle, which focuses on synchronisation of spoken words (audio) with graphics and placement of text near corresponding graphics, and (iii) the personalisation principle, which advocates using narration in a voice suitable for children with good sound quality. Software design should also include options to enable adults to adjust the design to the target reader, for example, by including a choice to turn the background music off (Bus et al. 2015). As their guiding principle for app developers, the researchers stress that the youngest children may have limited mental resources, and therefore, various forms of assistance that are helpful for older children, such as dictionary or word pronunciation features, should be offered in such as way as not to distract the youngest readers. However, age should serve only as a guidance, as the maturity of pre-schoolers executive functioning may be more informative (Richter & Courage, 2017) (see also section 'Accessible').

Accessible

Digital reading platforms have the potential to provide more accessible reading opportunities for young readers with special or additional needs. Digital devices "have special assistive features", notes Oakley (2019, p. 203), "that can help children who have hearing, visual and motor impairments, as well as those with learning and language difficulties". In particular, voiceover can read the screen for those with vision impairment, hearing aids can be paired directly with the device for better sound

quality, closed captions can make content accessible for those who are hard of hearing, braille devices can be made available for vision impaired readers, and various switch devices, such as trackballs and other tactile assistive devices, can provide different types of control over content for readers with motor disabilities.

Digital devices can make books accessible from anywhere and can be brought into any setting outside of home and school (Wauters & Dirks, 2017), thus increasing accessibility to readers who are on the move or isolated. Digital books can also have an adaptable layout and, therefore, display text in a more accessible way. The most important features of accessible digital books, as identified by McNaught and Alexander (2014), are: screen reader compatibility, screen magnifiers, text-to-speech, customisable background and text colour contrast, and alternative text description for images and tables. Adjustable text size, text and background colour, and spacing are key indicators of accessibility for readers with dyslexia (Rello et al., 2012).

Digital books can increase accessibility by incorporating a variety of multimodal features and reading cues (such as, print, image, sign language, dictionary), as discussed previously (see above section 'Interactive'). This has been found to be useful in promoting reading comprehension as well as reading for pleasure for deaf children. Text-relevant, animated illustrations that are accompanied by dynamic comprehension exercises, and extended with a dictionary are effective digital reading design features that help deaf children to better comprehend a written text and increase reading enjoyment (Mich et al., 2013). Moreover, the multimodality of a digital book, as Gentry and colleagues (2005, p. 398) write "has the potential to allow the deaf child to determine the mode of information presentation best suited to [their] needs". Similarly, a well-coordinated range of media has been found to have a positive effect on reading improvement of children at risk for reading disabilities (Shamir et al., 2011). For children with complex needs, "who cannot verbalize their stories, the option to take a picture or add a simple sentence/word in writing is an appealing one" (Kucirkova et al., 2014a). Similarly, researchers found that the audio-record feature is essential for children with motor difficulties who cannot type or hold a pen. A comic strip activity was found to significantly improved literacy achievement in children with autism by reengaging reluctant young autistic readers in reading and learning (Oakley et al., 2013).

Observing the interaction of children with complex needs with the *Our Story* app, Kucirkova and colleagues (2014a) noted how the wide range of customisation options within the app (such as adjustable font or background format) was a positive feature of the app and supported the learning targets relevant to each individual child. Accessible digital books are, therefore, books that are flexible enough to accommodate the different needs of various young users by offering customised and individualised experiences. An accessible digital text must be perceivable and understandable, and the digital reading platform design must be operable and compatible for different uses (see also section 'Child-friendly'). There is, however, a rising concern that the accessibility of digital texts is not developing in parallel with the growing capabilities of digital technology, and that accessibility is neither constant nor consistent in children's technologies (see Botelho, 2021). Given that accessibility is one of the key considerations for schools (Mune & Agee, 2016), there is an urgent need to carefully attend to accessibility features in digital books and highlight successful accessible design that promotes effective participation for all children so that the potential of digital books in reaching all readers can be realised.

Personalisable

Personalisation of printed books has been found to support children's comprehension (Bracken, 1982), vocabulary acquisition (Kucirkova et al., 2017), and shared reading experience (see also below section 'Social'). Personalisation in learning, and in digital books specifically, includes various possibilities. In the context of technology-enhanced learning, Fitzgerald and colleagues (2017) developed a framework for mapping the personalisation features, which Kucirkova (2018) further adapted for digital books. The personalisation features focus on (a) what is being personalised (e.g. story characters, location, plot), (b) type of learning (e.g. enjoyment, motivation, learning new words), (c) who is doing the personalisation (e.g. the child, the parent, the technology provider), (d) how does personalisation happen (e.g. images, audio, text adaptation), and (c) who benefits from the personalisation (the child, teachers and/or parents, other children, the technology provider).

Personalising children's learning experiences is an important part of effective pedagogy (Bloom, 1984) that seeks to engage learners in content delivery. Technology-enhanced personalised learning uses children's personal and performance data to predict and adapt, and thus individualise, their learning experience. Such adaptive learning applies to reading with screen-based technologies, where children's progress, such as reading comprehension tests, is tracked and their subsequent reading experience is adjusted and individualised. The data collecting algorithms, often including AI, create a seamless reading experience (Kucirkova & Mackey, 2020). However, while this may be beneficial for many children and in many ways, it may also present the "'one-size-fits-all' problem that may disadvantage large numbers of learners" (Kucirkova, 2018, p. 258; see also Kucirkova & Mackey, 2020), that is, the personalising algorithms are not always sufficiently advanced and flexible to accommodate the full diversity of readers. In addition to this concern, personalisation features provide heightened focus on the child's 'self', for example, by allowing the child reader to become the hero of the story, and the effects of this on children's social development are still unknown and need to be further examined (Kucirkova, 2018).

In addition to the personalisation of individual books, personalisation on digital reading platforms can take the form of reading recommendations. Reading recommendations are based on the idea of adaptive learning, where the content that is offered to the child is highly curated by the system provider and/or the child's teacher/parent. These digital library management systems may include customisation, social media integration, profile creation, data storage, and personalisation options based on user history and self-declared or automated preferences (Kucirkova & Cremin, 2018). The recommendation algorithm collects personal and usage data and matches the data with the library database. This is based on like-like logic, similar to, for example, in the entertainment industry music or film subscription platforms, where users with similar characteristics are expected to like similar content and individual users are expected to continue enjoying what they have enjoyed in the past (Kucirkova, 2019c). The advantage of recommendation systems in children's reading platforms is that they efficiently handle large amounts of content and can streamline it according to users' responses. In addition, from an educational perspective, reading recommendation systems might provide teachers with access to greater reading content; however, at the same time, it might also minimise their role as reading supporters and reposition them as reading monitors and curators (Kucirkova & Cremin, 2018). The difficulty with reading recommendation systems is that by making the reading

process smooth and at all times engaging, it ceases to be in any way challenging. The lack of challenge in selecting texts on their own limits children's agency as children are not invited to actively select books that misalign with their preferences or books outside of their comfort zone (Kucirkova, 2019c).

Examining a different side of personalisation, Kucirkova and colleagues (2021) suggest that personalised books, which focus explicitly on the child's individual identity, have the potential to enhance reading enjoyment and motivate reluctant readers. In a similar vein, Kao and colleagues (2019) explore the incorporation of selfies within digital books, finding that this feature can enrich role-playing activities, increase reader engagement, and boost motivation, especially when the selfies reflect the emotional tone of the story. Kucirkova (2019c) further recommends that designers create opportunities for cognitive challenges, encourage children's agency and content creation, and develop databases that are open-ended rather than linear in nature. These recommendations aim to foster critical thinking, empower children, and encourage their active participation and contribution to the reading experience, while closely attending to children's personal needs and preferences.

Creative

Creative engagement is central to meaningful and deep learning, and nurtures creative skills that are essential for problem-solving and critical thinking. Creativity is one of the essential elements of children's engagement with books that nurtures reading for pleasure (Kucirkova et al., 2017). Unfortunately, many popular digital books are not designed to offer new literacy experiences and new opportunities to engage with stories creatively, and therefore do not realise their full creative potential (Kucirkova, 2019a; Vaala et al., 2015). Kolak and colleagues (2021, p. 415) suggest that "[a]pps which give the opportunity for exploratory use alongside structured activities, might increase children's intrinsic motivation and engagement". Digital books designed to invite children to interact with them, to introduce new elements, and to co-create or create their own stories, produce an "intellectually immersive" experience, nurture creativity, and enable "complex processes of interpretation of text" (Aliagas & Margallo, 2016, p. 49). Empirical research confirms these recommendations. Lin and colleagues (2018), for example, found that an augmented reality (AR) environment, and interactive environment that combines the real world and computer-generated content, in which children can interact with the topic of their learning, such as feeding a caterpillar, and create their own content by drawing caterpillars' environment on a touch screen, not only improved learning motivation but also increased the children's imaginative capabilities and thereby fostered creativity.

In a recent systematic assessment of a selection of commercially available apps aiming to determine their effectiveness in supporting children's creativity, a sample of 152 Android apps, targeted at children aged 4 to 12 years, and claiming to foster creativity, was collected from three different sources (Booton, et al., 2023). The quality of these apps was evaluated using criteria derived from research evidence on factors that enhance creativity, such as experimentation and modelling. The findings revealed that the sampled apps were primarily designed for younger children, featured open-ended activities for individual use, required in-app interactions, and mainly focused on visual arts, personal, and social-emotional activities. The overall ratings for creativity were relatively low, particularly in terms of supporting convergent thinking and modelling creativity. Notably, key app

store data, including review scores, installation numbers, payment information, and expert approval, did not consistently predict the quality of creative apps. However, apps designed for older children generally received higher ratings. These findings highlight the insufficient quality of current apps targeting children's creativity.

Design that seems to be promising in nurturing creativity is open-ended, inviting children's contributions and collaborative interactions. Children's creativity, characterised by what researchers refer to as higher-order talk with questioning, listening, and scaffolding, was found to be best supported by apps and digital books with an open-ended design (Kucirkova et al., 2014b). "Community early authoring can help children find their own voices," writes Kucirkova (2019c, p. 312) but in order to encourage this, digital books need to provide technical support as well as guidance on effective communication around the joint creations of stories.

Opportunities for parents and children to creatively co-create digital books were found beneficial by Kucrikova and colleagues (2013), who argue that collaborative, multimedia, personalised stories nurture positive engagement with text and open new sharing processes for children and their parents. Early authoring opportunities, especially those designed to include avid, as well as reluctant readers, and children from all groups in society, may also contribute to children's agency and gains in confidence around books (Kucirkova, 2016). In another study, it was found that children engaged in more exploratory talk and joint problem solving around story-creation and drawing tasks (Kucirkova, et al., 2014b). Open-ended prompts that invite children to elaborate a narrative and create different stories, should therefore be formulated in such a way as to give children the freedom to choose how they construct their narrative (such as audio retelling or picture story) and leave room for richer interactions between the child and the text (Rubegni et al., 2021). Kucirkova and colleagues (2014b) conclude that the more easily accessible open-ended content a digital book has, the more likely it will have a creative value.

Unstructured play-activities such as role-playing games, and non-linear interactive narratives such as choose-your-own-adventure stories, have been found to foster emotionally charged experiences and increase children's autonomy, participation, and decision-making during digital book reading (Aligas & Margallo, 2016). Nevertheless, interactive and play-based features may also disrupt learning and narrative comprehension (Sargeant, 2015), especially if interactivity is not a well-situated part of the story (Aliagas & Margallo, 2016). A careful balance between these features is therefore necessary for optimal creative engagement. An example is *The Fantastic Flying Books of Mr. Morris Lessmore,* which includes games such as a virtual piano, a jigsaw puzzle, and arranging letters in a virtual bowl of cereal, that, although they are embedded in the story, are only loosely connected to the narrative (Sargeant, 2015). Such interactions prevent children from reading the entire story, hamper story comprehension, and instead trigger what Smeets (2012, p. 12) calls a "play-based mode". An effective synergy between the story and a role-playing feature, was found by Kao and colleagues (2019) in the role-playing picture digital book *The Prank in the Forest,* in which children could take emotive selfies and merge them into the character in the book they wanted to play. This innovative mode of self-expression allowed the readers not only to appear in the story but made the story personally meaningful, prompting readers to become immersed in the story and make connections between the characters, text, and other images on the page. Open-ended, exploratory, and play-based features and activities should, therefore, direct readers' attention to the story, be thematically linked, and be connected with the narrative content and the book's core theme, so as to engage young readers and enable active and creative participate in digital storytelling experiences (Sargeant, 2015; Yokata & Teale, 2014).

Social

Shared reading and dialogic interaction around books, referred to here as the 'social' indicator of quality, is one of the most desired reading practices for language and literacy development in young children (Noble et al., 2019; Rvachew et al., 2017; Tomopoulos et al., 2019). Reading together with a parent or an adult introduces greater language complexity and draws children's attention to foundational aspects of emergent literacy such as letter-sound correspondence and further reading progress (Rvachew et al., 2017). Shared reading also encourages children and parents to reminisce and reflect on personal experiences which has been found to be an important aspect of enjoyable and memorable reading sessions for children (Kucirkova et al., 2021). Reminiscing during reading turns reading into a more positive social experience for struggling and reluctant readers, while promoting bonding between a parent and a child (Abdehaldi, 2020; Kucirkova et al., 2013). Indeed, Avelar and colleagues (2022) found that children develop more positive reading experiences when reading with parents, than when reading alone. Some digital books include an automatic 'read-to-me' function and therefore allow pre-readers to engage with books independently (Dore et al., 2018), while others allow for parents' input, or provide a hybrid option for voiceover controlled by the user.

The social indicator of quality connects to literature that shows that well-designed digital books can provide high-quality reading opportunities that are equally as engaging as print books (Strouse et al., 2013). Built-in conversation prompts can nurture a richer conversation between parents and children (ibid.) and together with feedback, can encourage parents to ask questions, elaborate the story, and scaffold children's learning (Yang et al., 2022). Hotspots, designed to emphasise the main themes in the digital book and to support understanding of the storyline, can prompt and guide discussion and encourage children and parents to ask more questions and return to characters or scenarios they enjoyed (Abdelhadi, 2020), thus fostering social reading sessions.

When reading on iPads, children are more likely to share ideas and model actions with each other (Simpson, et al., 2013), highlighting the potential of the interaction around digital books for collaborative and participatory learning. This is echoed by Christ and colleagues (2016) and Kucirkova and colleagues (2014b) who note that digital books support effective peer talk among children and inspire peer reading interactions. Such rich, multidirectional, and complementary interactions were also noted among siblings when unique reciprocity happens during digital reading as they aid each other's learning (Siibak & Nevski, 2019). Kucirkova and Cremin (2018) argue that optimised digital books can also help build reciprocal reader relationships among teachers and pupils and help nurture networked communities of readers. They suggest that keeping a "multimedia communal record" for each book and "texts in common" help establish teachers and pupils as co-readers who share knowledge and listen to each other (ibid., p. 17–18). "Teachers and students could overlay the books they read with their own voice overs, extended texts, short videos, geo tags or embedded hyperlinks" and thus develop effective dialogue and a reading community (Kucirkova and Cremin, p.582). It follows that social indicators related to digital books need not hamper active interpersonal relationships and instead strengthen social relationships among children, their peers, and/or adults (Bai et al., 2022).

Multimedia digital books that offer parasocial interaction, such as on-screen characters, can also offer valuable dialogic and scaffolding experiences that promote children's literacy skills and social interactions (Strouse et. al, 2013; Kolak et al., 2021). Strouse and colleagues (2013) found that an on-screen actress embedded in digital storybooks can help parents involve children in dialogic reading that improves story comprehension and increases vocabulary acquisition. A questioning character in digital books can model dialogic behaviour, increase frequency and quality of parent-child talk, and

train adults in how to challenge children's literacy skills during shared reading (Troseth et al., 2020). A friendly pop-up computer pal, a furry ball with eyes, designed by Smeets and Bus (2012) to guide children through text and ask questions, helped children to gain 18% more receptive and expressive vocabulary which is comparable to shared reading with an adult. The literature consistently emphasises that only high quality parasocial interactions, however, are beneficial to children (Kolak et al., 2021; Hirsh-Pasek et al., 2015; Papadakis et al., 2018)

Finally, research shows that children not only enjoy listening to other people but also enjoy listening to self-reading books, that is books that automatically read the text (Bai et al., 2022). Children often interact with digital devices independently as parents and adults may not always be strong readers or available to read with their children (Rubegni et al., 2021; Dore et al., 2018). Therefore, "talking e-books have been assumed to provide a useful and distinctive digital scaffold for children's emergent literacy" (Pereira, et al., 2019, p. 273). For example, Dore and colleagues (2018) found that while digital book audio narration is not an equivalent substitute for a shared reading with a parent, children can comprehend some of the content from audio-narrated digital books concluding that "using e- books independently may be a worthwhile activity for preliterate children while caregivers are otherwise occupied" (ibid., p. 24). Comparing live reading with an adult and listening to audio- narrated digital books, O'Toole and Kannass (2018) found that listening to audio-narrated books can lead to greater attention, increased word learning, as well as better comprehension of text.

Research shows that successful digital book design, that promotes interactive dialogic reading, should contain not only well-balanced audio and visual prompts (guiding children through the reading platform and providing children with meaningful engagement with text) but also open-ended prompts that leave room for elaboration and imagination, foster recall, and stimulate children's reflection about a character's feelings and thoughts (Rubegni et al., 2021; see also section 'Creative'). Digital books and portable devices lend themselves to shared reading and story sharing (Kucirkova et al., 2013) but content that promotes joint media usage is sorely needed (Lee & Barron, 2015). As digital reading technology advances, social engagement around books is on the rise, and new forms of interactions, specifically co-reading, co-viewing, and particularly co-playing, are taking centre stage in children's reading experiences (Troseth et al., 2016).

POPULAR READING PLATFORMS AND ONLINE LIBRARIES

The ten digital libraries we examined are a diverse group of digital reading platforms with different content, size, cost, and aims. Appendix 2 in this report provides detailed information on each of the libraries' size, types of books, languages offered, cost, and data protection practices. In this section, we discuss what these reading platforms and online libraries are like from a research point of view, and to what extent they support high-quality reading experiences and engagement. In particular, we highlight the most successful features within these libraries that best support and align with the nine quality markers we present as essential for high-quality digital reading.

The ratings were assigned by the first two authors of this report. Both researchers individually reviewed each platform and rated it according to the evaluation rubric. To do so, the researchers downloaded the libraries/apps on their personal devices and engaged them in the main user mode. In alignment with the goal of this report, the platforms were rated for their quality features, not for the quality of content of the individual stories. For each platform, the researchers compared their scores and discussed discrepancies to arrive at a consensus rating. The figure below (Figure 2) shows the researchers' overall ratings of the platforms. The following descriptions of individual features were jointly written by both authors to explain their ratings and contextualise them with information available about the rated platforms from the platforms' information on their websites.

As explained in the section 'Our questions and approach', each platform is scored against the nine quality criteria following a scale from high through medium to low: high indicating that the feature is well incorporated into the platform, medium indicating some presence and low indicating very limited presence or absence.

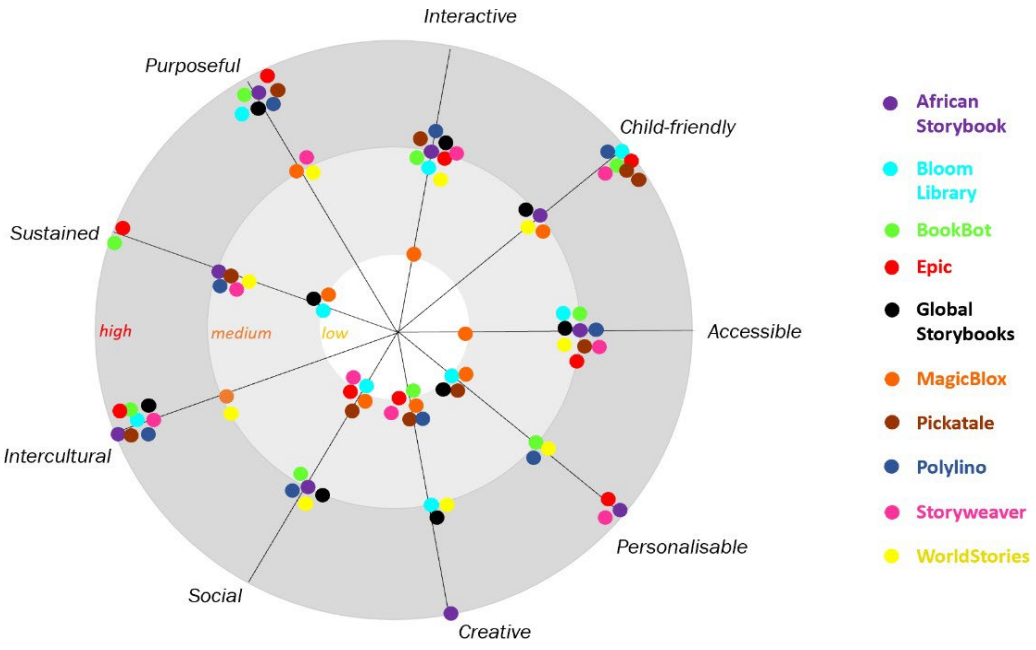


Figure 1. The prevalence of quality features in the digital reading platforms

While we did not attempt to rank the digital libraries against each other, Figure 1 offers a comparative view on the highest and lowest scoring platforms. In particular, it shows that three platforms scored high on four or five aspects: *African Storybooks* scored high on creative, personalisable, intercultural, and purposeful aspects; *Epic* on intercultural, personalisable, sustained, child-friendly, and purposeful; and *Storyweaver* on child-friendly, personalisable and intercultural. *Epic* and *BookBot* were the only platforms that scored high on the sustained quality indicator. No platform scored high on the social quality feature, though *WorldStories, Polylino,* and *African Storybooks* achieved the medium score. While some libraries, including *African Storybook*, achieved high scores on some aspects, they also achieved low scores on others, indicating that their quality varies in relation to specific quality indicators. In what follows, we describe the quality scores for each of the nine criteria and the ten platforms we assessed.

Purposeful

high	*medium*	*low*
African Storybook	MagicBlox	
Bloom Library	Storyweaver	
BookBot	WorldStories	
Epic		
Global Storybooks		
Pickatale		
Polylino		

Table. 2 E-libraries according to high, medium or low presence of elements supporting purposeful learning opportunities.

Digital libraries must have a clear purpose for a meaningful interaction and learning to occur. A clearly stated purpose should then be consistent with the library content as well as design, such as specifically designed hotspots that support story comprehension, or in-built dictionaries that support word acquisition, or a range of fun interactive features that nurture reading for pleasure. High quality digital libraries not only explain their aims but also acknowledge the team behind the platform, the funding bodies, and the content creators.

Most of the digital libraries that we evaluated were created with a clear direction and clearly stated purpose with well aligned content and features that support their aims. Nevertheless, all of the libraries could focus more on developing more design features such as meaningful parasocial interactive characters, open-ended games, or hotspots and other elements that would support their aims and enhance children's reading and learning experiences. Most of the evaluated libraries provided some basic information on the content creators and children book authors they feature on their platforms, but more information (including links to authors' websites and other works, for example) may be helpful to schools and families as they pursue their reading activities further. This is particularly relevant in the case of libraries that offer a large proportion of their signature content. Moreover, knowing more about the team behind the digital libraries encourages and improves communication among the product creators and its end users. This allows not only to share ideas but also opens a user forum for addressing any concerns and mitigating risks which may arise in the online environment.

African Storybook was created to be an open access reading resource for African stories in multiple languages of Africa. The digital library makes the stories accessible globally to support African diaspora outside of Africa and promote the stories and voices of the Global South. To that end, the developers engage a network of African authors to provide a library of contextually appropriate picture storybooks and traditional tales written in 40+ languages of Africa (including English, Portuguese, and French). The *African Storybook* engages a mixture of known writers, literary professionals, language consultants, and partner organisations to create and edit its content, but more accessible and detailed information on who these contributors are would be valuable to their readers.

One of *Bookbot*'s aims is to build children's reading confidence in "less than a month" which is underlined by their broader mission to address the issue of low literacy levels worldwide. Their levelled books, and learning to read through phonics approach, aligns with the British curriculum and their educational aims. *Global Storybooks* is similar to *African Storybook*, a free multilingual reading resource designed for readers of minoritised languages of Canada (indigenous languages), immigrants, and refugees (Figure 2). The platform promises its readers that the translations were not AI generated but carefully translated by native speakers from around the world as well as carefully proofread and edited by multiple speakers of the respective languages before being added to the library. All their authors and illustrators are clearly identified and presented with a short bio including their motivation for writing books.

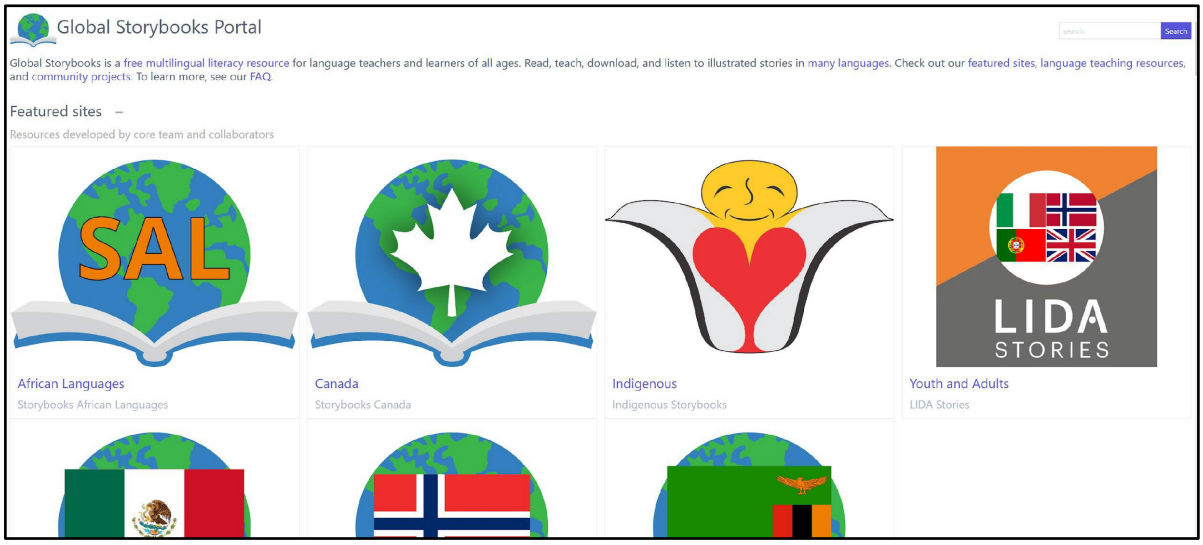


Figure 2. The *Global Storybooks* is a free multilingual reading resource especially designed for readers of minoritized languages of Canada, immigrants, and refugees.

Polylino was designed for teachers and educators to be used in preschool classrooms. Their digital library of books aligns with the UK EYFS (Early Years Foundation Stage) and Key Stage 1 (5 to 7 years) curriculum and aims to support all UK children's emergent literacy and language development. *Polylino's* books are therefore translated into most of the spoken languages in the UK. The books have been selected by UK children's literature experts and written by award winning authors. In addition, *Polylino* provides teachers with guidance that was developed by UK children's literature experts. *WorldStories*' mission is to help transform the lives of disadvantaged children and young readers whose first language may not be English and who may be struggling to learn in an unfamiliar language and environment. The library provides illustrated stories in many different languages to help children

to read; but there is more the platform could do to support its aims and provide richer learning opportunities for disadvantaged learners in the UK. For example, developers could drop hidden costs, address scenarios with limited internet access, engage professional translators and diverse children's authors.

The *Bloom* library, on the other hand, is not necessarily uniquely focused on young children, though it has a substantial number of books suitable for young audiences. Their mission is to make books available more widely by focusing on minority languages. The library therefore contains books in over 550 languages (including, for example, Tok Pisin). The library is based on crowdsourcing and open access principles and contains a 'create' section, where content producers can upload their books or translations. As a crowdsourcing project, some of the quality features, such as language or translation quality and variety of content, may be compromised. There is a very limited offer of fiction texts, but the sheer number of languages is commendable.

Epic platform's focus is primarily educational and on the development of children's positive reading experience with the majority of books in English. *Epic* works with children's motivation to read and offers diverse reading content in terms of format, topics, and genres. It also contains built-in reading comprehension tools (quizzes) and vocabulary development supporting tools such as dictionary and spotlight words. In addition, the library includes an engaging blog. *MagicBlox*'s mission is to encourage children "to explore other cultures by providing them with books in many languages including English, Spanish, French and Italian." The library contains many high-quality books, the majority in English but with a clear aim to expand into other languages. *MagicBlox* has also launched a crowdsourcing effort to grow the library.

The wide selection of books in the *Pickatale* library supports the library's aim to develop children's enjoyment of reading. This digital library also contains an engaging blog and other sections that explain its purpose and highlight the importance of reading. The *Storyweaver* library contains books by a not-for-profit publisher and its aim is to make stories accessible to children in their mother tongue. As of May 2023, the library includes books in over 300 languages. Each book also contains information on its creators, see Figure 3.

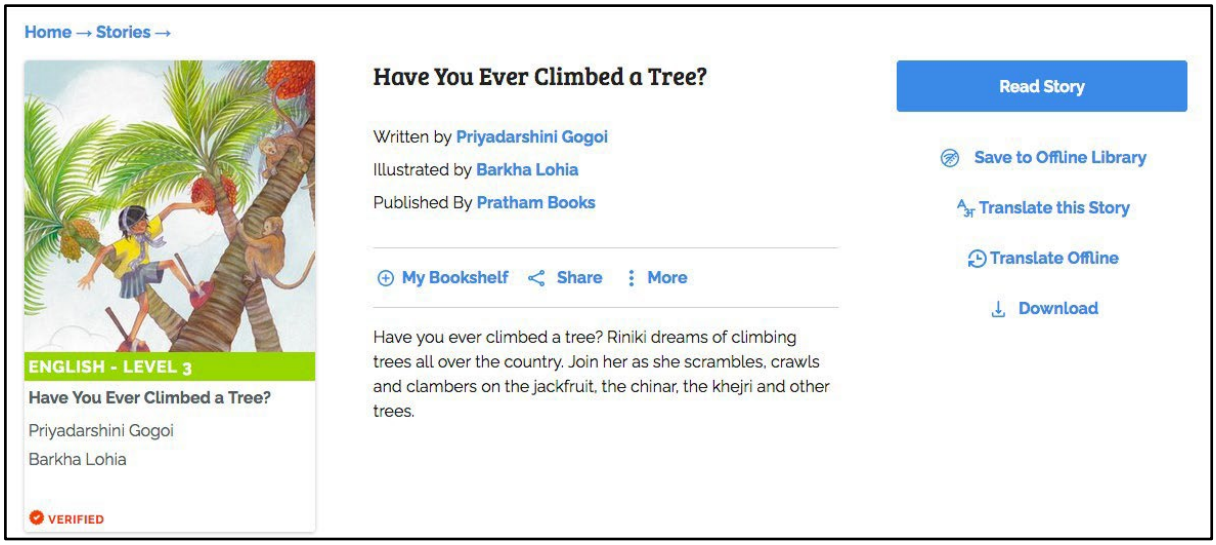


Figure 3. View of a book in *Storyweaver*.

Sustained

high	*medium*	*low*
BookBot	African Storybook	Bloom library
Epic	Pickatale	Global Storybooks
	Polylino	Magic Blox
	Storyweaver	
	World Stories	

Table. 3 E-libraries according to high, medium or low presence of elements supporting sustained learning opportunities

High-quality digital libraries motivate children to return and re-engage with their content not only across multiple sessions but also within each reading session. Re-reading books and re-visiting stories and characters supports sustained engagement with books and children's literacy development. Repetitive interactions with books can be encouraged by simple design features such as personalised bookshelves and the option to save read books and access one's own reading history, and also through various prompts, progressive levels, learning goals, or through playful open-ended design and changing content. Most digital book platforms include some of these elements in their design but to further nurture interest, engagement, and learning, all the platforms could do more to entice and encourage young readers' repeated interactions with the content by specifically encouraging children to revisit the vocabulary, characters, and stories in their library.

To keep readers interested, the *World Stories* platform adds new stories, translations, pictures, and sound recordings every week. Teachers can assign tasks, send messages, provide assessment, and place children in groups which may encourage repeated interaction with books within one and across multiple sessions. Similarly, the *African Storybook* regularly adds new content while also engaging readers through their open-ended 'Maker' app experience. The *Global Storybook* offers levelled books and links to other sites with reading resources, both of which may encourage deeper engagement with reading in young children. The *Global Storybook* provides multiple translations of their books, which is a helpful feature for multilingual families and young EAL readers, who can then re-read stories in different languages with their family members in addition to reading at school. A practical feature that can support a more sustained reading in young readers is, for example, a bookmark embedded in the *Polylino* library. The bookmark remembers where children stopped reading and allows them to start from where they left off. Helpful navigation tools in *Polylino* also enable children to page back and forth in the story to re-read or re-listen to different passages.

Figure 4. *Bookbot* allows children to tap on words and listen again as they are being re-read.

A noteworthy feature that encourages re-reading and returning to new words on a page is the *Bookbot*'s feature that allows children to tap on words on each page and listen to the word again as they read it out loud (Figure 4). As children read, they are rewarded with colourful stickers that they can collect, and the reading content is also continuously upgraded to reflect children's interest and reading level. The books in the *Bookbot* library can also be read off-line allowing children to read without internet access. Offline mode is beneficial as digital books are often read by children who don't have Internet at home or when children are on the move, for example, when children travel to school or during long waits at doctor's office.

The *Bloom* library and *MagicBlox*, on the other hand, do not contain any specific prompts for repeated interaction. However, their book reading navigation easily allows for going back and forth as a reader would with a "traditional" paper book. In addition, *MagicBlox* allows users to select their favourite books by "liking" them, which consequently allows the children to return to those books easily. In the *Epic* library, each child has their own bookshelf in their profile, which includes their favourite books. Books are also downloadable and can thus be read offline similarly as, for example, in *Bookbot*. In addition, children gain badges and awards for their reading effort which encourages further reading. During the reading experience, a progress status is shown that estimates the time remaining to finish the book (see Figure 5). Similarly, in *Epic*, each child has in their profile a library of books they have read, and children are awarded with badges for their reading effort. Unfortunately, books cannot be read offline. *Storyweaver* offers their readers personalised bookshelves, and their books can also be printed and read offline (see Figure 3).

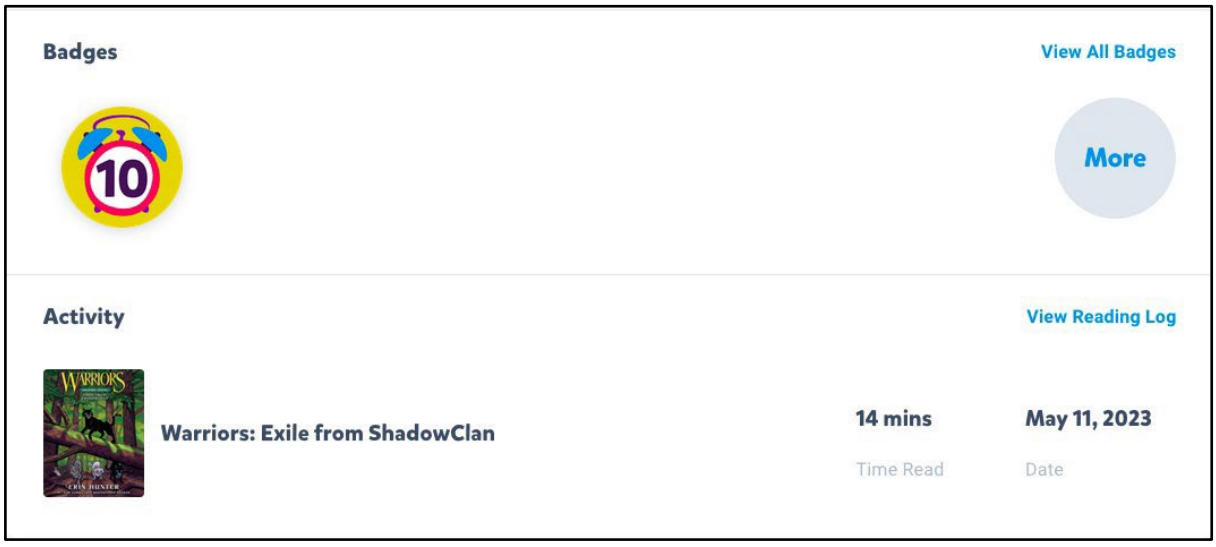


Figure 5. A 10-minute reading time badge and reading log in *Epic*.

Intercultural

high	*medium*	*low*
African Storybook	Magix Blox	
Bloom Library	World Stories	
BookBot		
Epic		
Global Storybooks		
Pickatale		
Polylino		
Storyweaver		

Table. 4 E-libraries according to high, medium or low presence of elements supporting intercultural learning opportunities

Digital libraries need to reflect the diversity of their readers and provide children with positive learning experience about self and others in the world. This means, drawing on our literature review of research in this area, that digital book platforms should not only provide rich content with multiple means of representation, engagement, and action, but also content that empowers minoritised groups. This encourages children to interact and appreciate and understand people who identify with cultures and/or belief systems that are different from their own. Digital books should contain different types of content, such as fiction and folk stories, and also non-fiction books, that feature diverse practices, objects, and characters and that are written by diverse groups of authors. Such stories and books must be culturally sensitive and have real world relevance. Moreover, to promote cross-cultural dialogue and interaction, platforms should ideally offer multilingual navigation and content to allow families with different linguistic backgrounds to navigate the platforms with ease.

Most of the libraries we reviewed provide a positive learning environment about self and others, and offer children books with minoritised characters that are non-stereotypical. Some of the libraries also

directly ask or provide space for children's feedback and offer a space for building positive relationships as well as positive reinforcement while children read and spend time on the platform. While many of the platforms involve experts and authors from minority communities to develop their content, none of them report if minority groups have been consulted during the design/development of the platforms or, indeed, how children's views informed the platforms' design.

Thanks to their content and several noteworthy efforts, *Global Storybooks* and *African Storybook* provide some of the richest intercultural learning experiences among the platforms we reviewed. *Global Storybooks*, for example, has a library with books in 93 languages (including many languages of Africa and indigenous languages of Canada). It also uses the source text of their stories as a corpus to create stop lists that are used to improve data processing and online experience for speakers of under-resourced languages. Their central aim is to provide multilingual, open-source reading materials for children in poorly resourced communities, in order to democratise global flow of information and to show that valuing and supporting linguistic and cultural diversity is fundamental to reducing inequities in children's learning and development. The platform, for example, affords the opportunity for multilingual readers, including immigrants and refugees, to not only learn English and French through reading, but also to access books in their mother tongue. Thus, children and families of all language backgrounds have the opportunity to make choices about what and how to read.

Figure 6. One of the many folktale stories on the *African Storybook* platform.

Similarly, the *African Storybook* holds content in 40 different languages of Africa (including English, French and Portuguese) (Figure 6), and also emphasises the importance of their 'Maker' app developed especially for minoritised and vulnerable groups of children who can create and publish stories that represent their experience. In the 'Maker' app, characters can be personalised, and stories diversified. Additionally, it can be used in the classroom for collaborative exercises and for learning

how to create stories together. *Storyweaver* also offers a substantial collection of books in 336 languages. In terms of language variety, the *Bloom* library is the most extensive, with 587 languages (see Figure 7). It includes endangered languages, and uniquely also "World Englishes", and as such, is the only platform that offers several varieties of English.

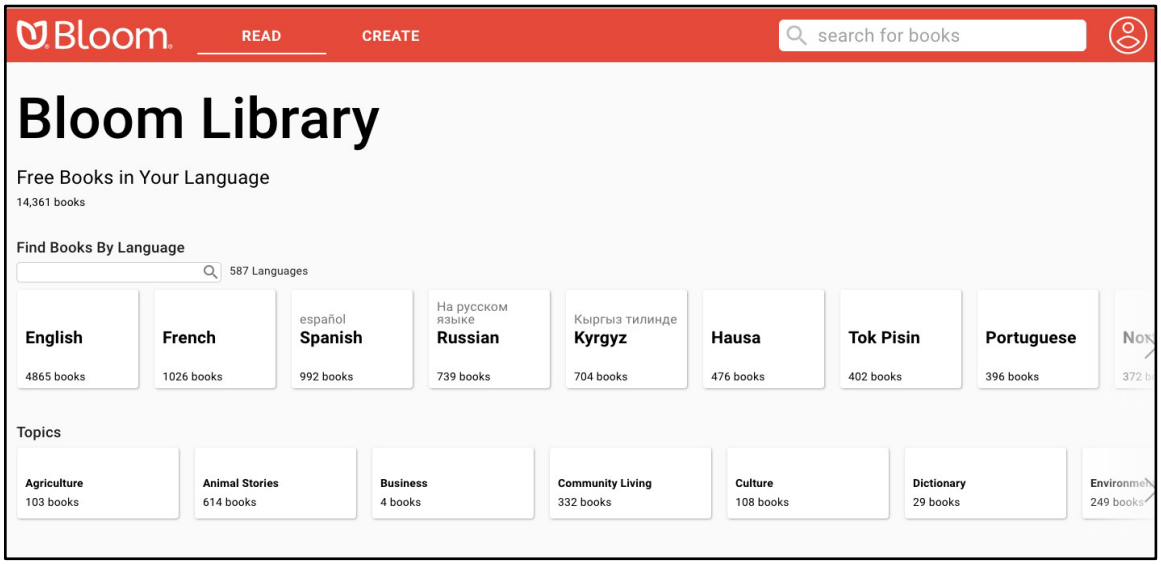


Figure 7. The *Bloom* library landing page showing some of the languages that are offered.

The *Polylino* library can be navigated in multiple languages (Swedish, German, French) and contains books written by internationally renowned and diverse writers. Children can share their favourite books with each other within the *Polylino* platform, which allows every child to highlight and bond over stories that are relevant to their experiences. *Pickatale* offers its content, including the fully localised interface, in English, Danish, Swedish, and Norwegian. The platform recently responded to current world events and started adding books in Ukrainian. The book selection offers diverse content and the website promises a "Diverse Offering" by "[c]hallenging underrepresentation and modelling inclusion."

Similarly, the *World Stories* library emphasises that stories can help us celebrate diversity and to learn from each other. It therefore makes its content available in many languages, specifically, 33 of the languages most commonly spoken by UK children. Its collection includes not only well-known stories, but also new short stories and retold traditional tales. The *Bookbot* library contains books by diverse authors and with diverse characters and day-to-day experiences, and also connects readers to external international digital book collections (such as the Let's Read, Papua New Guinea book collection). A noteworthy effort, however, is the way the *Bookbot* team focuses on accommodating children's different accents and its attempts to eliminate the *Bookbot*'s 'listening' feature's bias by responding to any accent.

Epic's content is mainly limited to English with some content being developed in French, Spanish, and Chinese. The platform is US based and offers, in terms of its content, good diversity that is curated by both experts and user feedback. Similarly, *MagicBlox* has the majority of its books in English but includes books in French, German, Italian, and Spanish. The library content is once again reasonably varied.

Interactive

high	*medium*	*low*
	African Storybook	Magic Blox
	Bloom Library	
	BookBot	
	Epic	
	Global Storybooks	
	Pickatale	
	Polylino	
	Storyweaver	
	World Stories	

Table. 5 E-libraries according to high, medium or low presence of elements for congruent interactive reading experience

A high-quality, interactive, digital book library encourages quality interaction between its user and digital books by employing a variety of media, such as animation, videos, games, sounds, or word enhancing features. These provide meaning and ideas in different formats that children can control, turn on and off, slow down, or change according to their needs. All of the digital reading platforms we evaluated in this study are to some extent interactive and contain some multimodal features, though for many the interactivity was rated as low. None of the platforms were rich in congruent multi-media, but neither were any of them found to contain excessive amounts of animations, hotspots, videos, or other interactive features that could distract young readers.

Of the evaluated libraries, the more interactive are the *Bookbot*, *Epic,* and *Pickatale* platforms. They offer more dynamic reading experiences with multiple interactive features that enrich readers' interactions with text. *Epic* has interactive features present both during the reading experience and within the library itself. *Epic* contains, for example, 'read to me' books where audio narration can be switched on and off as needed and the child can read at their own pace as the pages are turned manually with a page-turning sound. During the audio narration the read text is highlighted, and many of the books include a dictionary activated by hovering over the word with a mouse, see Figure 8. While the usefulness of embedded dictionaries in children's digital books continues to be debated by researchers, the option for switching it off and on could be very useful to diverse audiences and bilingual readers interested in practising languages.

Figure 8. The dictionary in the *Epic* library. The dictionary includes pronunciation, though the meaning definitions do not seem to be fully adjusted for young readers and may need the support of an adult to be fully benefited from.

In *Pickatale*, multimodal features are present in most of the books: the books can be either read or narrated. It is possible to flexibly switch between the options and browse through the book content. The non-audio versions include an added pronunciation of the individual words if the user taps on them, while the narrated version highlights the words that are currently being read. The *Bookbot* platform has a special interactive feature: a friendly, customisable, animated character that acts as a reading assistant. The character listens to the children as they read aloud and provides instant feedback by modelling pronunciation or rewarding the child's progress with stickers (Figure 9). In the *Storyweaver* library, some of the books have the "read to me" function and during the audio, the read text is highlighted. Some of the books may also contain a non-interactive comprehension exercise at the end. The *Global Storybooks* platform contains only non-congruent audio narration, but teachers can use an 'Audio Cloze' test for each book to support children's comprehension and vocabulary development. More importantly, however, the *Global Storybooks* platform provides suggestions and guidance for parents and practitioners on how to develop multimodal engagements with their books. The developers, for example, encourage adults to incorporate music into reading to identify emotions or ask children to create 3-D objects to reflect on the various themes in their books. On the other hand, the *African Storybook* platform contains only basic interactive features (such as page swiping) and no read-out-loud function.

Figure 9. The *BookBot* interface with a friendly, interactive character.

The books in the *Bloom* library are mostly text but some titles also include audio narration during which the read text is highlighted. The library also contains "motion" books with background music and narration; the motion books do not contain text and are thus meant for listening and watching only. Some books include comprehension quizzes. Similar to other platforms, *Polylino* has no hotspots, animations, or other more complex multimedia features. It does, however, have an engaging interactive paging feature, which encourages interaction between the child-reader and the books. Similarly, the *World Stories* library has no multimodal features besides audio narration. It does, however, contain many learning activity prompts for teachers, which could potentially distract readers due to their random positioning and excessive length. The *MagicBlox* library contains both text only and text with audio books (unfortunately, the audio feature is not fully optimised for all browsers and screen types).

Child-friendly

high	*medium*	*low*
Bloom Library	African Storybook	
BookBot	Global Storybooks	
Epic	Magic Blox	
Pickatale	WorldStories	
Polylino		
Storyweaver		

Table. 6 E-libraries according to high, medium or low presence of elements for child-friendly reading experience

A child-friendly library is a library that young children can easily interact with. In this study, we are specifically concerned with the experience of primary and pre-primary children ages 3 to 8 years old, and we therefore focus on whether the digital reading platforms contain well organised and easy to navigate content for this particular age group. Drawing on the literature that we reviewed, child-friendly platforms should be developed with children in mind, or better yet, be co-designed with children positioned as experts with valuable insight into digital book design and content features that concern them. While none of the libraries we evaluated reported having been co-designed with children, most of them are clearly designed with children in mind. In this respect, the *African Storybook* platform stands out with its offer of tutorials on its story-maker app that were made with children, for children. None of the platforms included commercial elements such as ads, negative messaging, or concealed harmful content. Most, with only a few exceptions, contain simple, standalone messages, clear objectives, and have well-ordered and clearly categorised libraries to help children find books that match their interests. The most successful designs have meaningful icons and easy menus, as well as easy to read titles and descriptions of characters.

The *Bookbot* library's bright design and easy layout is among those that stand out as particularly child-friendly. Specifically, its icons are well designed; they are meaningful, unobtrusive, and easy to read and access. Similarly, *Polylino* is designed in a very child friendly manner. It offers two different modes, a paired down and age-appropriate version for very young children aged 3 to 5, and a full version with a personal bookshelf and the option to change languages, among other features, for older children (Figure 10). The different modes not only allow improved accessibility for younger children, but they also make it possible for families to set up different profiles for siblings of different ages. On the other hand, though the *World Stories* library has a straightforward design without excessive icons or menus, children have to sign in and learn to navigate its many pages (e.g., library, personal profile, support videos). The library is, therefore, less appropriate for pre-readers and more appropriate for primary school classrooms, where teachers can involve children in different reading activities and tasks.

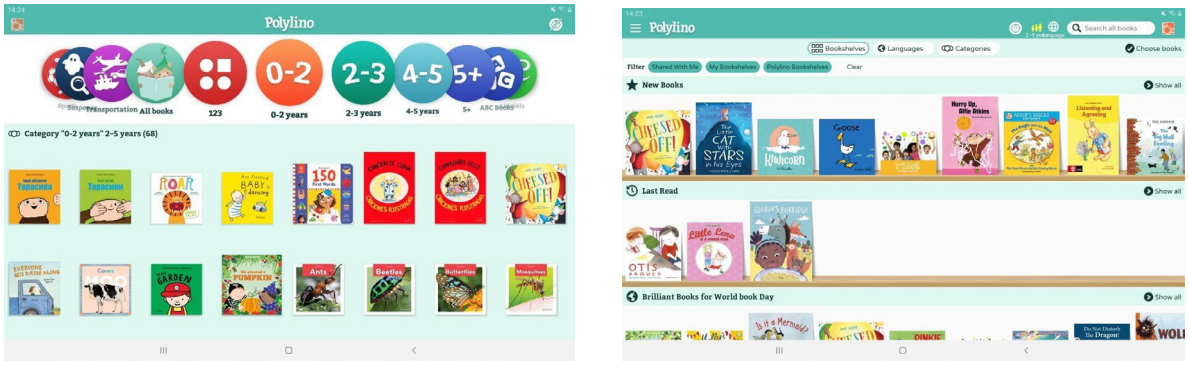


Figure 10. *Polylino* has two different child-friendly interfaces for readers to choose from.

Global Storybooks offers a child-friendly design with suitable navigation control panels, where children can flip back and forth in the story, switch among languages, or quickly access read-to-me functions. However, the platform's overall style seems to be more geared towards adults signalling that adult

moderation of its vast content (93 languages) is needed to help children find their way. The navigation in the *Epic* library is straightforward and mostly intuitive, though, for example, the sound activation icon is situated too far off the main visual field. Adjusting the screen size to fit the screen with the open book view may also be too difficult for the youngest age group. The book recommendation system is highly personalised – based on the initial selection – which does not easily allow searching for books "outside" of the recommended range.

The navigation in *Pickatale* is also reasonably straightforward and intuitive. The book selection (scrolling both sideways and up/down) is based on genre classification and each book has its own categorisation based on reading stages. The selection process for the youngest readers, however, may be more of a "trial and error" nature than conscious understanding of how the platform works. In *MagicBlox*, the navigation is uncomplicated and allows for full control, similar to a paper book. The book selection is based on reading level, category (genre), features (illustrations, music, narrations, sound), language, and listing date. The design is basic and uncomplicated but perhaps not suitable for the youngest readers.

Storyweaver has uncomplicated navigation within the library and its book recommendation algorithm recommends further reading based on the rating of the finished books. The *Bloom* library offers a very basic interface and its design clearly expects adult supervision, especially for book selection. The library is extensive, and the content is organised according to languages, broad topics with labels that may not be entirely child-friendly (e.g. 'Agriculture'), special interests (e.g. STEM, Bible), book mode (e.g. Talking, Activity, Comics). The non-intuitive organisation might be due to the *Bloom* library being a crowd-sourced platform that is not intended for children only, and thus a child is not expected to use the platform without assistance.

Accessible

high	*medium*	*low*
	African Storybook	Magic Blox
	Bloom Library	
	BookBot	
	Epic	
	Global Storybooks	
	Pickatale	
	Polylino	
	Storyweaver	
	World Stories	

Table. 7 E-libraries according to high, medium or low presence of elements for accessible reading experience

Accessible digital reading platforms should cater to, and accommodate users with different needs, including but not limited to neurodiverse readers, readers with hearing loss, or readers with special educational needs. Accessible libraries must not only be perceivable and understandable, but also operable and compatible with multiple hardware and software to accommodate different uses (e.g.

such as visual aids, screen reader, joystick, or mouse) that allow for a variety of interactions. Research shows that accessible digital platforms should have modifiable text and layout, story simplification, combined pictorial, auditory, and text explanations, multiple multimodal features, and allow for different forms of engagement with the text (e.g., print stories, audio narration, games, etc.) Unfortunately, none of the platforms we reviewed contained a rich selection of accessibility tools and most did not even have the standard set of accessible features.

One of the libraries that was more developed in this regard is *Bookbot*. Though it does not contain certain features, like screen magnifiers, and has some bugs, *Bookbot* is designed with dyslexic and vision impaired readers in mind. The library, for example, offers a customisation option for visually impaired readers, or a follow-along feature, during which its *Bookbot* assistant keeps track of reading position in the text. Some of the other digital reading platforms also offer some interesting accessibility features worth noting. The *African Storybook*, for example, does not have any common accessibility features or visual aids, but together with a partner organisation, it is printing its storybooks in both large print and in Braille. These books then come with 3-D printed modules that allow readers to touch and feel the main characters in their stories and thus enhance diverse readers' understanding and enjoyment of the *African Storybook* content.

The *Global Storybooks* platform has a dedicated collection of stories for adults, EAL (English as additional language) readers, resources for speech therapists and hearing professionals, and books that are transcribed into IPA (International Phonetic Alphabet). It also provides an audio storybook jukebox that automatically reads a list of stories out loud on autoplay. *Polylino,* with a library of books in 65 languages, was designed to support language development in EAL children and is available for both tablets and desktops. A useful feature is its zoom function that readers can use to zoom in on both text and images. The *WorldStories* library allows readers to print out stories and modify the text and background in their books.

There do not seem to be readily available accessibility features in *Pickatale,* but when the audio read-aloud option is turned on, the text is highlighted, which may support some struggling readers. Some books come in various formats, some of which will be better accessible than others. Similarly, *Epic* does not offer accessibility features other than text highlighting during audio narration and various book formats, with some aiming to reach SEN (special educational needs) readers. The platform also offers a thematically curated collection labelled 'Neurodiversity'. *Storyweaver* is similar in this respect. It is, nevertheless, worth noting that most books contain highly engaging and age-appropriate audio narration.

MagicBlox does not contain any clear provision for accessibility, and unfortunately, the platform has some technical compatibility issues, which makes it even less accessible. The only notable exception in the evaluated set of libraries is, to a certain extent, the *Bloom* library, that contains a number of books for visually impaired that have bigger font size. The books in the *Bloom* library are clearly labelled in terms of whether they contain audio, are appropriate for visually impaired, are comics or motion books, have sign language support and whether they include interactive features. Most of the books are also labelled with difficulty level (see Figure 11).

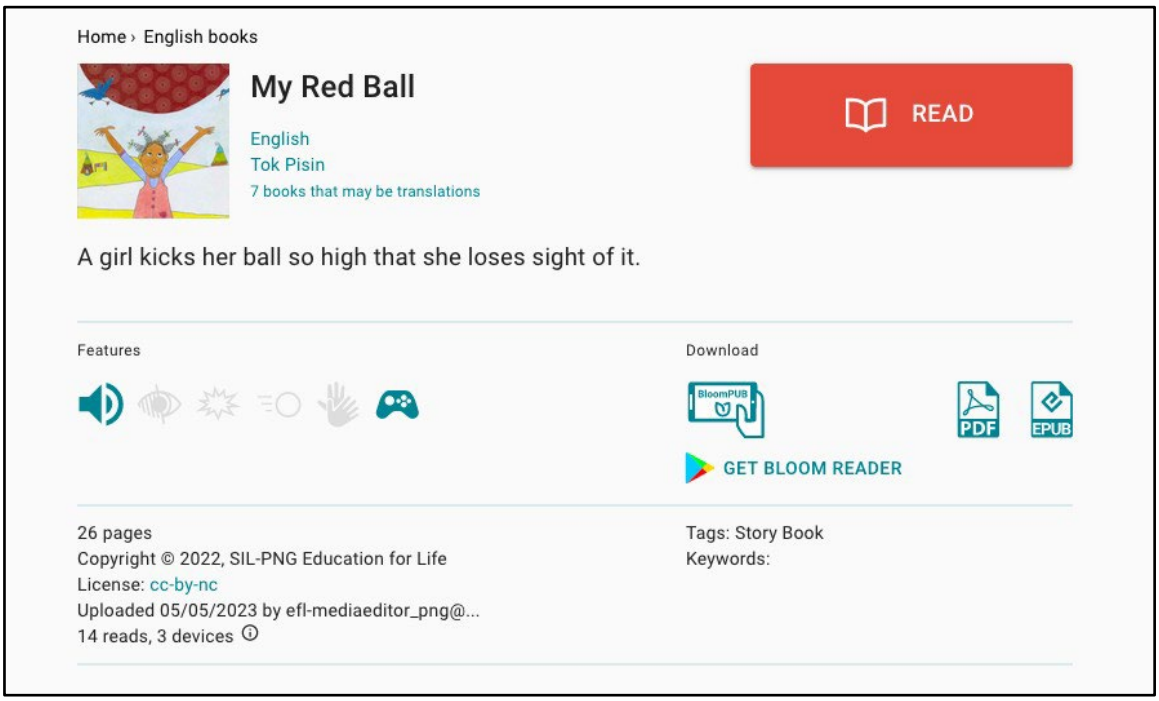


Figure 11. An initial book view in the *Bloom* library with icons indicating the book properties and accessibility features.

Personalisable

high	*medium*	*low*
African Storybook	BookBot	Bloom Library
Epic	Polylino	Global Storybooks
Storyweaver	WorldStories	Magic Blox
		Pickatale

Table. 8 E-libraries according to high, medium or low presence of elements enabling personalisable engagement

Personalisable digital book libraries can adapt their design and content to their readers' preferences, allowing the readers to directly manipulate content or add their own data. The most successful personalisable platforms will have adaptive learning software, curated content, personal avatars, personalisable books, reading statistics, or other forms of personalised reader feedback. Other important features may be content recommendations, reader profile, tailor-made hotspots, badges, and rewards. Among the ten evaluated platforms, some are somewhat customisable, a few are personalisable, but most need further development in this area.

The *WorldStories* library, for example, has a customisable content and format that allows teachers to curate content as well as tasks and reading activities for individual students. However, beyond providing a personal account, the library is not personalisable in the sense that children cannot curate or co-create the content or add their own ideas and images that speak to their personal contexts. The *Bookbot* library is not personalisable either, as children cannot curate or co-create their own content,

but its adaptive learning software recommends books based on the children's reading level and interests. *Bookbot* also encourages parents and children to get in touch with the developers to propose new ideas for books that the children would love to read.

African Storybook offers a story-making app, in which communities of readers or individual readers can create their own stories and their own content using and building on stories from the platform. In *Polylino*, children have their own profile and personalise their own bookshelf, but the library provides no recommendations and only adults, such as parents and teachers, can curate content to suit children's needs. Similarly, *Global Storybooks* offers almost no personalisation on its platform. However, children are encouraged to download their books and personalise their content and format, or download images, words, and audio from the digital library's archive and create their own stories. The *African Storybook* has a personal library feature where books that children have already read are saved, a place they can return to and re-read and re-engage with familiar stories and books.

Epic offers several personalised features. Upon the first log-in, basic information, such as age and interests, is provided and the recommendation algorithm suggests the content for the users' first reading. After that the algorithm works based on the reader's past behaviour. Each reader has a profile and gets a reading buddy, which is, in essence, another recommendation algorithm. Further, there are "weekly inspirations" (fun facts and hands-on activities) alongside badges. The platform explains its proprietary algorithm "constantly learns about your child's reading preferences and progress, delivering personalised recommendations for your child along with input from our panel of experts." In addition, children may create their libraries based on their past reading and selected favourites, however, they cannot create their own content.

MagicBlox offers very basic personalisation features in the form of "liking" books and having them placed in the "My favourites" section. In *Storyweaver,* every registered reader has their own profile. There are "Tell us about yourself" and "Set your reading preferences" sections, which presumably feed into the recommendation algorithm. The *Bloom* library contains no personalisation features; however, this is due to the fact that the books are read without logging into the platform. In *Pickatale,* every child has their personal avatar and a profile with their own library of books they have read and/or liked. The profile records the number of books read, minutes spent reading and rewards the child with badges (see Figure 12). The interface seems to be, unfortunately, non-adaptable.

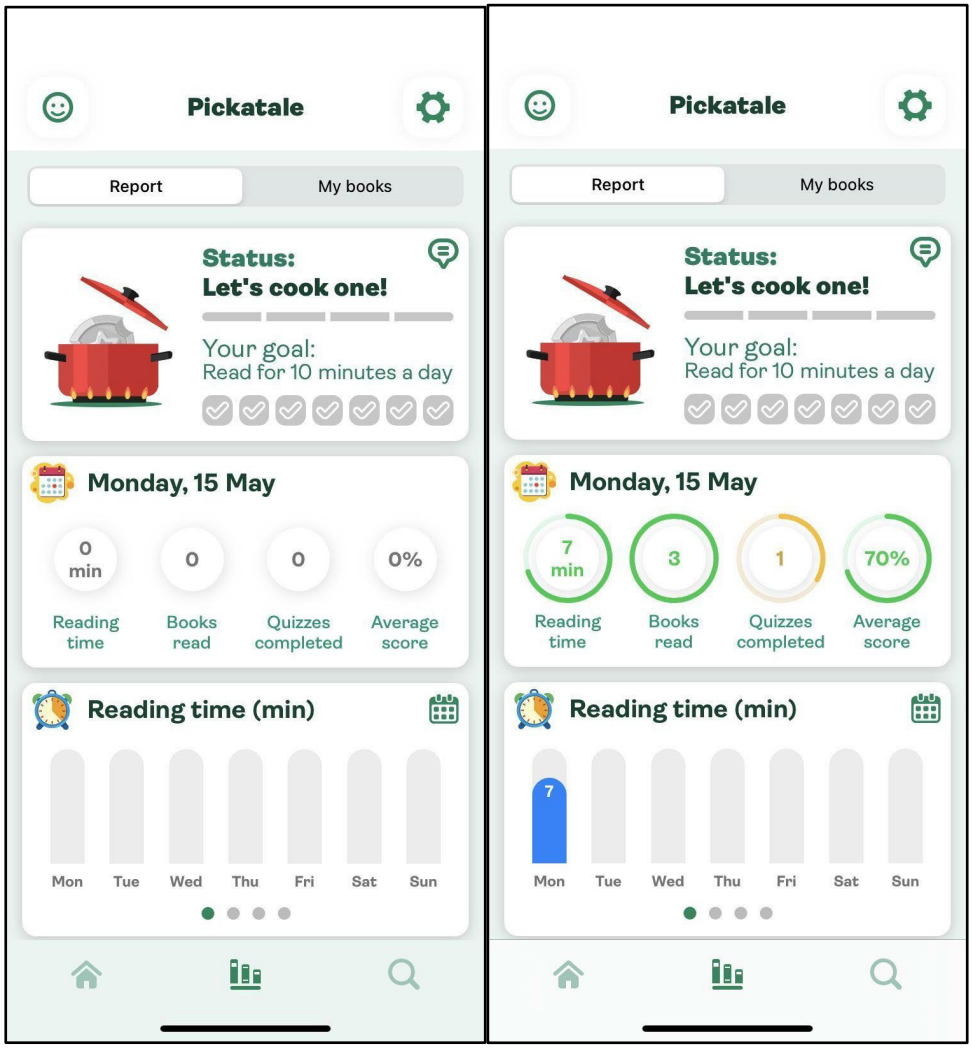


Figure 12. *Pickatale* creates a personalised profile for every reader including reading statistics and further recommendations.

Creative

high	*medium*	*low*
African Storybook	Bloom Library	BookBot
	Global Storybooks	Epic
	WorldStories	Magic Blox
		Pickatale
		Polylino
		Storyweaver

Table. 9 E-libraries according to high, medium or low presence of elements enabling creative engagement

Digital book libraries that promote creative engagement need to contain open-ended and exploratory design and content features that encourage 'possibility thinking' and 'what if' questioning. As

discussed previously (see section 'What makes a good digital book?') open-ended content, imaginative elements, AR, and other creative tools that encourage exploration, provide space for imagination, and allow transformative interactions and creation of novelty, are important aspects for developing new opportunities for children's creative engagement with books. Most of the libraries we reviewed, unfortunately, do not create many opportunities for creative engagement and contain only a few or no features, such as AR or creative games, that would enrich children's reading experiences. For example, other than having imaginative stories as part of their library, *Bookbot*, *Epic, MagicBlox, Pickatale, Polylino* and *World Storybook* offer minimal opportunities for creative engagement.

In *World Stories*, teachers can upload content and activities that link to stories and therefore additionally encourage dialogue, 'what if' and 'what else' questions, and novel responses. In the 'Maker' app of the *African Storybook* platform children can create their own stories that link to the stories they read on the platform (Figure 13). Similar creative engagement, with downloaded stories, is encouraged by the *Global Storybooks* that additionally invites children to upload and share their new adaptations on the site. The platform also offers illustrations of their books as colouring pages to be downloaded and worked with creatively in the classroom or at home.

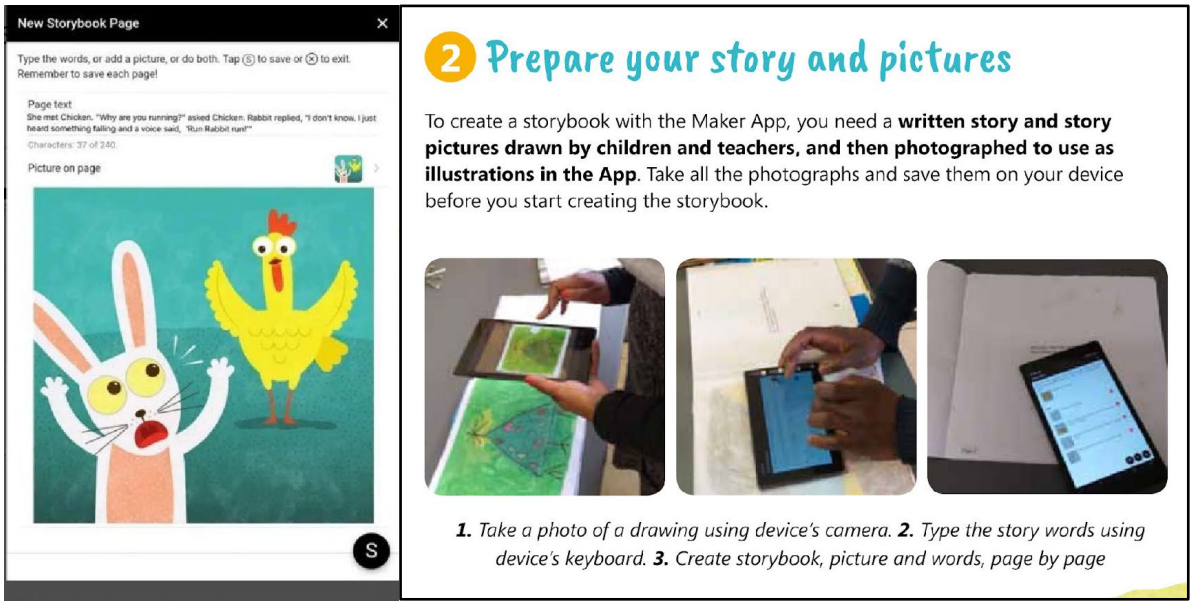


Figure 13. *African Storybook* Maker app where children can create their own stories.

Storyweaver includes a crowdsourcing option, and the platform has a section dedicated to content creators – storytellers, translators, illustrators. This feature is not primarily aimed at children but with appropriate adult supervision, it may present an interesting opportunity for older children. The *Bloom* library is in this sense similar, with the platform divided into 'read' and 'create' sections. While the 'read' section does not contain any creative elements, the 'create' section is designed to include new content, which can include new translations and adaptations, and also new book projects. However, the same constraints would apply as with *Storyweaver,* and adult supervision is required.

Social

high	*medium*	*low*
	African Storybook	Bloom Library
	BookBot	Epic
	Global Storybooks	Magic Blox
	Polylino	Pickatale
	WorldStories	Storyweaver

Table. 10 E-libraries according to high, medium or low presence of elements enabling social engagement

Social engagement is one of the most desired literacy practices and digital reading platforms that create opportunities for dialogic and collaborative interactions, either social or parasocial, such as co-reading, co-viewing, co-making, and co-playing, afford a higher quality reading experience for young readers. Features such as activities for multiple readers, parental support, social and scaffolding prompts, or video narrations and questioning avatars that enact effective parasocial interactions, can all nurture richer interactions around books. Despite the fact that the digital format lends itself to shared reading, most digital book platforms are designed to support independent reading only. Indeed, most of the digital book libraries we evaluated contained only one or two design features that encourage and enhance joint usage.

The *Bookbot* library provides some guidance for parents and teachers on how to get involved in children's reading but otherwise does not contain conversation prompts or other joint activities to accompany its books. It does, however, offer parasocial interactions with a friendly bot who reads together with children. The bot is rather simple and does not interact excessively with readers, but it listens to children, provides feedback, and encourages children to practise special words. The *Epic* library is similar in this respect – it seems to be expected that parents and teachers will step into a supervising role within a library that is visually appealing and thus suitable for shared reading moments. The app's inbuilt dictionary contains some very advanced definitions and assumptions of understanding basic grammatical categories, such as word classes, and is therefore probably inaccessible for many young readers. The library contains a parasocial character, a reading buddy (Figure 14) that helps, for example, with choosing books.

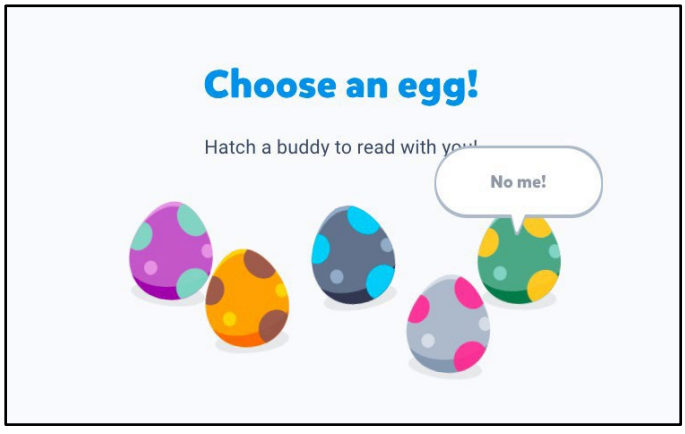


Figure 14. *Epic* encourages its readers to choose a 'reading buddy' in the form of a colourful egg. After the child chooses one of the eggs, it is hatched, and the child's reading buddy character is revealed

The *African Storybook* library does not contain any collaborative features or scaffolding prompts, but users can comment on books and read the comments of others. More social interactions around the books are generated through its already mentioned 'Maker' app, where children can create stories together and share them with their friends and family. While the *Polylino* library encourages parents to read together with their children, and explains why this is a desirable activity, it does not contain any hotspots or scaffolding games that would support dialogic reading. However, a useful feature is *Polylino*'s 'Share with Others' option, through which children can share books and view books shared with them.

The *Global Storybook* library does not have any design features that would enhance or encourage co-reading, co-viewing, or co-playing around its books, but it encourages and provides space for different communities of readers to create their own libraries on the platform. For example, its 'Indigenous Storybooks' archive allows Indigenous communities of Canada to develop and curate their own library of books, thereby providing an important online space where Indigenous people can share their stories and change how they represent themselves to each other and to others.

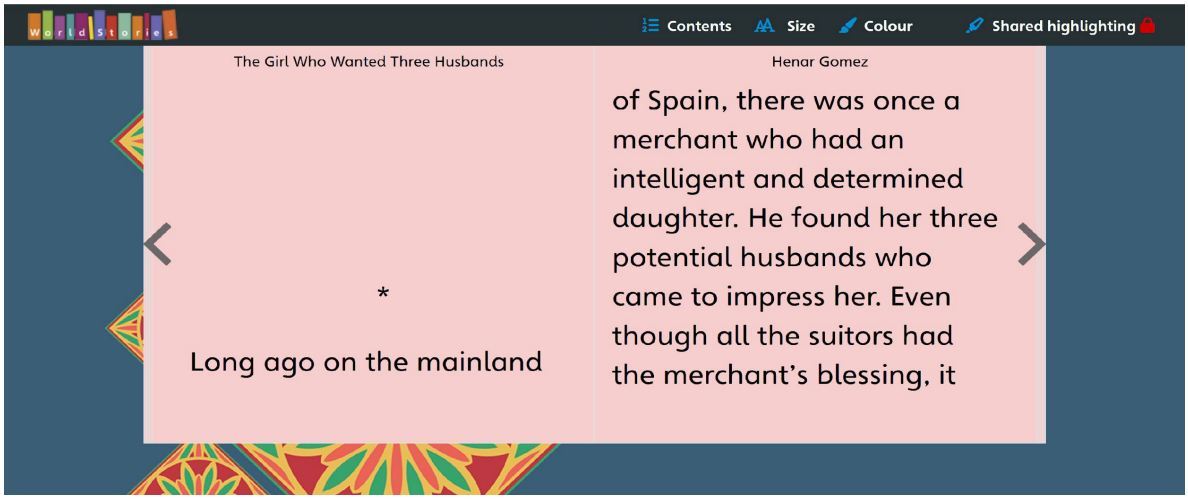


Figure 15. The *WorldStories* books have a shared highlighting feature that allows teachers and pupils to comment and reflect on the same book.

Finally, the *World Stories* digital library (Figure 15) does not encourage parent-child interaction as it is mainly designed for school use. However, it allows teachers to highlight passages in books and assign group tasks around specific texts, and therefore encourages peer-to-peer interactions around shared readings. Similarly, *Bloom, Pickatale,* and *Storyweaver* in its individual reading view, do not contain features encouraging social aspects of reading. *MagicBlox* is similar, however it does contain social media share buttons (e.g. Twitter, see Figure 16), which, we are assuming, are aimed at the adults that read the books with their children.

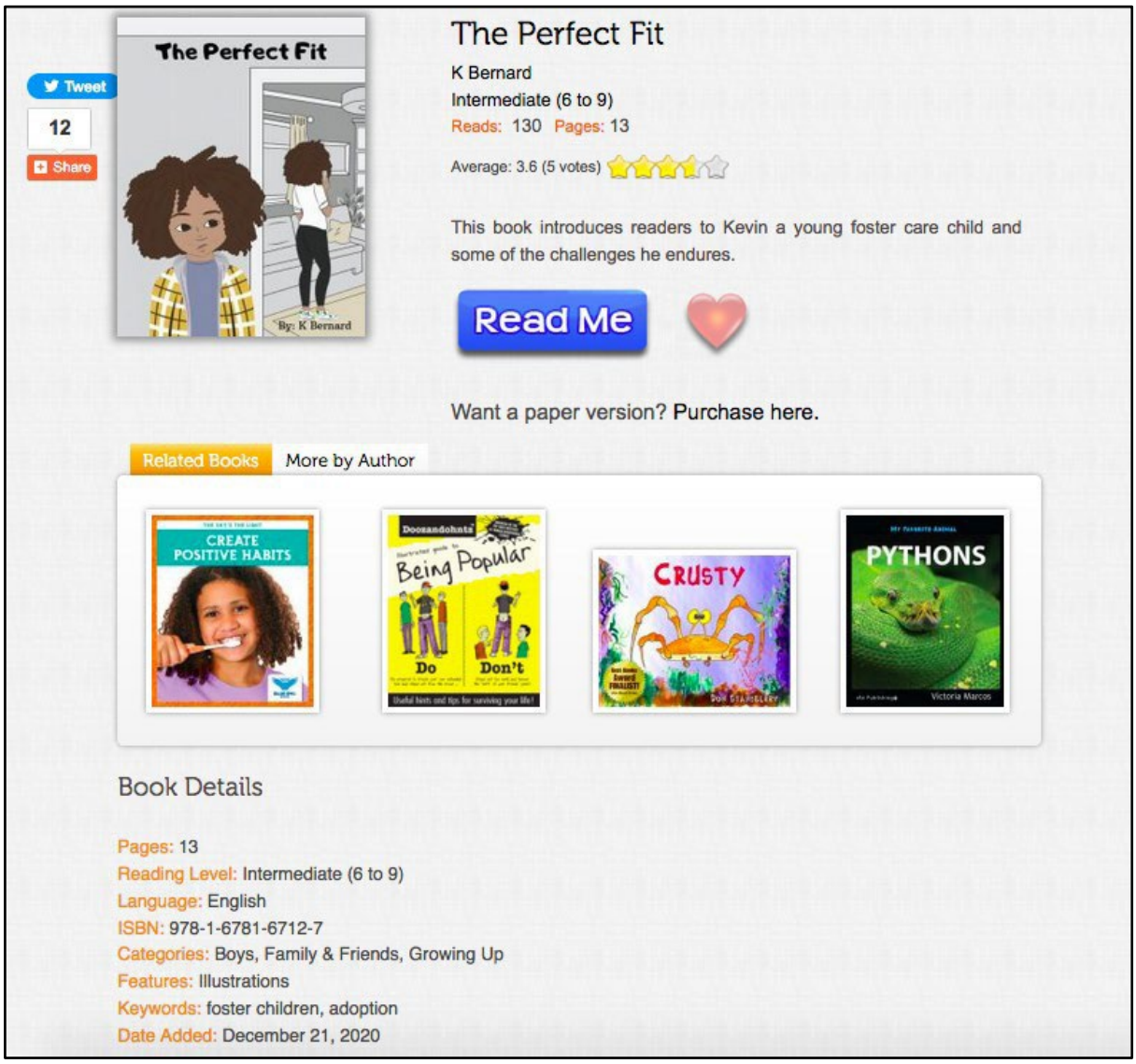
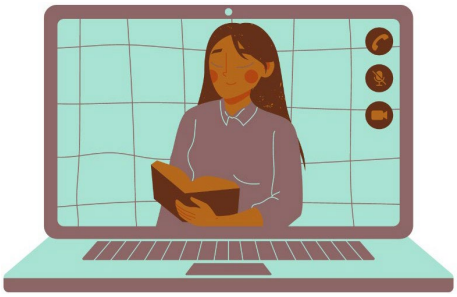


Figure 16. A bookview in the *MagicBlox* library.

SUMMARY

The contemporary children's digital book market is growing at a fast pace; however, the quality of digital books is largely unregulated. Quality digital children's books are expected to offer a reading experience that goes beyond the traditional paper book medium. Being enriched by interactive and multimedia features, and by including spaces that support creativity, imagination, dialogue, and possibility thinking, digital books have the potential to create both virtual and physical social spaces. Such spaces can encourage shared reading experiences and much-needed wider social interaction, by creating communities of readers, however small or large. Technology is available to be harnessed to its full potential to create supportive, inclusive, and safe environments for learning and reading for pleasure. Digital books also have the potential to be more cost-effective and accessible and thus offer more equitable reading opportunities. However, while the research on children's digital books is extensive, there are still many unknowns that need to be considered, and more research in this field is needed. This is especially true in the area of literacy skills development and the ways that children learn with digital technology more generally.



In an attempt to gauge the quality of currently offered digital books, we conducted a literature review to derive quality criteria and used these to evaluate a selection of ten digital book libraries for their potential to support children's engagement in reading. We focused on the features of the digital platforms and considered the different purposes of children's books, such as their learning, social, and aesthetic potential. Nine criteria were selected to explore the extent to which the digital book libraries offer quality learning opportunities, support a high-quality user experience, and promote quality engagement with stories beyond "mere" reading. We ask whether the platforms are designed in a purposeful way, whether they offer sustained interaction, whether the content is sufficiently diverse and intercultural, whether the design is interactive, child-friendly and accessible, whether there are personalisable features, and whether the space opens up possibilities for children's creativity and social interaction.

We found that most of the digital libraries we evaluated were created with a clear purpose, with reasonably well aligned content and design features. Most of the evaluated libraries provided some information on their content creators and featured children book authors and illustrators, but more information is desirable, particularly for libraries with their own signature content. More openness in this sense would also encourage more meaningful interaction between the developers and users.

Most of the digital platforms we evaluated, to some degree supported sustained interaction with their content, but there is still considerable space for improvement. For example, the development and inclusion of design features that encourage various forms of repeated motivational interaction with the stories, be it to revisit some of the vocabulary, engage with the characters in creative ways, or engage with the content in different modalities (audio *vs.* text), would improve many of the platforms.

In terms of the intercultural aspect of the libraries, most of the libraries we reviewed offer a positive learning environment, and some of the libraries focus on, for example, providing books in less spoken languages. While many of the platforms involved authors from the global majority to support the development of their content, none of them offered interactive games or more advanced personalisation features that would allow children to develop intercultural competences. In terms of language representation, the *Bloom* library was the most extensive, including well over 500 languages, including the varieties of English spoken around the world. However, more research into diversity, equality, and inclusion, as well as transformative, decolonising design in children's digital books is needed, as currently there is very little guidance for the platform developers.

All of the evaluated digital reading platforms contain some interactive features, although none of the platforms were rich in congruent multimedia features. As far as the child-friendly design is concerned, some platforms are not designed with a child-user as their primary end-user in mind and expect an adult supervision throughout the reading experience. *Polylino* stood out with its simplified version for very young children, and a full version with a personal bookshelf and several customisable options for older children. Nevertheless, all of the platforms may want to consider collaborative design, and the inclusion of children in more active ways as co-designers.

While none of the reviewed platforms had a very extensive selection of accessibility tools and design features, some of them did aim to consider a wider range of readers (for example, *Bookbot* is designed with dyslexic and vision impaired readers in mind by including customisation options and support of the virtual assistant). The lack of support for the big community of diverse SEN (special educational needs) readers is noteworthy and more provision for multilingual readers, including EAL (English as additional language) readers, would strengthen all platforms.

Some level of customization seems to be a standard feature across the libraries. A good child-friendly design with adaptive learning software and a range of personalisation features for a wide variety of readers should, however, constitute the core of a digital reading platform's design today. Thus while some libraries provide opportunities for children and adults to personalise their reading experience, more can be done to engage readers and make reading for children a more tailor-made learning experience.

As far as encouraging creativity, most of the platforms provide limited opportunities for creative engagement. An increased focus on creativity through, for example, the creation and sharing of children's own stories or downloadable material that children can creatively interact with, would increase the quality of online digital book libraries.

The benefits of the social aspect of reading are stressed extensively throughout existing research. Nevertheless, it seems that most digital libraries are primarily designed to support children in independent reading. Where adult presence is expected, it was more in the supportive role of curator, rather than co-reader. This was, arguably, the greatest shortcoming of all the evaluated platforms.

In addition to evaluating the research-based quality features of the platforms, we briefly reviewed the libraries in terms of their library size, content, cost, and safeguarding practices. Here, the platforms' safeguarding policies, such as data protection and children's safety in an online environment are extremely important. Children are, by definition, vulnerable customers and developers must make every effort to protect them. An encouraging finding is that none of the platforms had any disturbing content or advertisements. However, while some of the platforms did not require the creation of personal profiles, most do. Though these are password protected, it is not always clear how well the measures utilised by the platforms protect their vulnerable customers. Only some of the platforms make their data protection and safeguarding policies fully clear. Safeguarding measures should not only be available in the technical text written, but they should also be directly and clearly communicated in comprehensible language to all platform users, including the children themselves. Children, even small children, need to understand what happens with the information and data they provide to the platform. Some of the platforms, like *Bookbot, MagicBlox* and *Storyweaver*, make a notable effort to clearly explain their safeguarding policies in detail, however, the level of communication is aimed at adults. None of the platforms provided safeguarding information in language that was accessible to children.

Our report is limited in that we followed an evaluation methodology that does not allow for quantifiable or direct comparison of the platforms. The evaluation criteria and their application to the platforms are descriptive rather than analytical, and our findings are of a qualitative nature. Therefore, in describing the findings, we use the examples of individual platforms to illustrate and concretise the evaluation criteria, not to compare one platform against another.

The strength of our report is that it relies on a comprehensive interdisciplinary literature review to derive the evaluation criteria, which were applied to widely popular and mostly free digital libraries, reaching millions of children. As such, the report maps the quality in the children's digital reading landscape and provides concrete, research-based, quality indicators for current and future children's digital books. We recommend that our work is expanded with a systematic, peer-reviewed study that applies more stringent evaluation criteria and standardised methodology for evaluation (e.g. inter-rater reliability calculations).

In conclusion, we encourage more dialogue between researchers, experts, and app developers to enhance the quality features of children's digital reading materials. There is a substantial amount of relevant research that could usefully guide these efforts. Although the technology is available, it has a long way to go to harness its full potential. The current digital reading platform offerings are commendable; however, we would like to stress the need for more openness and sensitivity in terms of how content is created and presented to children, the need for open-ended design that allows space for creativity, the need for joint and social reading opportunities, and more acknowledgment of children's agency – both as users of the apps, but also as co-designers of quality interactive books.

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Acknowledgments:
The authors would like to thank Professor Adriana Bus and Janine Campbell for their comments and constructive feedback on an earlier version of this report. We also acknowledge useful insights from Professor Cristina Sylla.

Suggested citation:
Vackova, P., Cermakova Lindroos, A. and Kucirkova, N. (2023). *Children's Digital Books: Development, Validation and Dissemination of Quality Criteria*. Stavanger: University of Stavanger.

Illustrations: canva.com

ISBN:978-82-8439-172-4

APPENDIX

Appendix 1. The evaluation grid of individual features and their ratings of high, medium and low.

	High	*Medium*	*Low*
Purposeful	Design and content align with a clearly stated purpose	Clearly stated purpose but the content and design are not aligned to it	No clearly stated purpose
Sustained	Carefully designed prompts for repeated interaction across multiple session and within a session	Some prompts for repeated interaction across sessions *or* within one session	No prompts or features that encourage repetitive interaction or sustained engagement
Inclusive	Content is relevant and accessible to culturally diverse readers, informed by experts from Black, Asian and minority ethnic groups, and design features support multicultural competence	Content is relevant and accessible to culturally diverse readers	Provides only one type of content and features for a universal user
Interactive	Contains multiple features that are available in various multimedia formats congruent with the story	Contains only a few multimedia features that are non-congruent with the story	Interactive features act as distractors from the story
Child-friendly	Easy to use, developmentally appropriate and designed with the child-user in mind	Easy to use but not particularly child friendly	Designed predominantly for adult users
Accessible	Contains a range of accessible language, format and content features	Contains some accessible features	Contains minimal or no accessible features
Personalisable	Content and format is customisable, individualizable, and personalisable	Content or format are customisable	Content and format are neither personalisable nor customisable
Creative	Contains creative elements and encourages users' exploratory use and imagination	Encourages minimal exploratory or creative use	Encourages no exploratory or creative use
Social	Encourages adult-child, parasocial and dialogic interaction	Encourages minimal adult-child or parasocial interaction	Includes no social prompts

Appendix 2. The table below provides a user overview of the platforms in terms of their library size, types of books that are included, languages that are offered, their cost and safeguarding practice. NB: the reported figures are accurate as of our access date in May 2023. From the publicly available information, we could not identify repeated use (number of returning users) or user attrition rates - aspects important for further evaluation.

COMMERCIAL DIGITAL READING PLATFORMS				
	Epic	**MagicBlox**	**Pickatale**	**Polylino**
Library	40,000+ books	-	2000+ books	+650 books
Book types	Fiction & non-fiction	Fiction & non-fiction	Fiction & non-fiction	Stories & non-fiction, rhyming poetic texts and nursery rhymes
Authors	Classics & developer content	Mixed content, incl. 'Award winning authors'	Developer content & international brands (incl. OUP, Marvel, Disney)	Known award winning, international children book writers
Languages	English (+limited content in Chinese, French, Spanish)	English & limited offer in French, German, Italian and Spanish	English, Danish, Norwegian, Swedish (with full interface adaptation) + some Ukrainian	English + other 65 languages
Purpose	Educational & reading for pleasure	Reading for pleasure & encouragement to explore "other cultures"	Educational & reading for pleasure	An online reading resource
Users	Children Parents Educators	Children 1 to 13	Children 3 to 11 Schools, Parents	Children 0-7, nursery staff and primary school teachers
Costs	Home cost: 7-day free trial Monthly/ annual ($11.99/ $ 6.67); up to 4 children School cost: free in the US	Home cost: 14-day free trial Monthly / annual ($4.99/ $38) School cost: $ 99 (annual, up to 50 students)	Home cost: 30-day free trial Monthly/ annual (£5.99/ 49.99) School cost: 3 subscription plans - 1. Premium: £6 per pupil/ year (2,000+ books, reading statistics, homework) 2. Light: £3 per pupil/ year (800 books, reading statistics) 3. Free (100 books)	Free trial. Paid service. Hidden fees.
Safeguarding	Clear safeguarding policy for schools; for home use, safeguarding information provided after sign up, incl. data protection	Detailed privacy policy	"Safe and accessible" and in line with GDPR. Terms & Conditions in "legalese" and thus it is not immediately clear what effort the platform makes in terms of safeguarding	No clear data protection rules but the platform is developed in the EU according to GDPR rules.

FREE DIGITAL READING PLATFORMS						
	African Storybook	**Bloom Library**	**BookBot**	**Global Storybooks**	**Story Weaver**	**World Stories**
Library	1500 approved storybooks for early reading	14,361 books in 587 languages	260 books (for each reading level)	Carefully curated collection of 40 interlinked stories	53,473 books	174 books
Book types	Picture storybooks	Mixed content, incl. translations and adaptations, extensive non-fiction	Fiction & non-fiction	Fiction & folk tales	Fiction & non-fiction	Some anonymous authorship
Authors	Network of African authors and traditional tales	International authors with no copy-rights	International authors & developer content	Stories repurposed from Africa n Storybook app	Content by the non-profit publisher Pratham (India).	Various genres & traditional stories
Languages	English + 40 languages of Africa, French, Portuguese	English (incl. English varieties) and 587 other languages	English Indonesian	English + 93 languages (languages of Africa, Spanish, French, Portuguese, German)	English and other content in 336 languages	English + other 33 languages
Purpose	Open access, contextually appropriate storybooks in the languages of Africa	Making books available, focusing on minority languages	Learning to read through phonics	Read, teach, download, and listen to illustrated stories in many languages	An endless stream of stories for all children in their mother tongue to read and enjoy	School resource including pupil and class management design features
Users	Parents, schools, children across the globe	-	Children, parents, School	Teachers & learners of all ages & all language backgrounds in Canada	Parents Educators Students	Schools
Costs	Free, books are open license, free to use, distribute and adapt	Free	Free	Free	Free	Free (upgraded to a premium account with more books/ hidden fee)
Safeguarding	No personal account and no use of personal data.	Accessible online without signing in; detailed explanation of safety issues	Strict privacy rules and data protection	No personal account and no use of personal data.	Clear and detailed safeguarding policy	No clear data protection rules or information on data protection.